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Journal of the Society of Arts.

*FRIDAY, MAY* 9, 1862.

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## CONVERSAZIONI.

The first Conversazione of the present season took place on Wednesday Evening last, the 7th inst., at the South Kensington Museum. There were about 3,000 persons present, including some of Her Majesty's Commissioners for the Exhibition of 1862, Foreign Commissioners, Jurors, Exhibitors, and others connected with the Exhibition.

The bands of the First Life Guards and of the Coldstream Guards were in attendance.

Two other Conversazioni will be held at the South Kensington Museum, on the 9th July and the 8th October.

## INTERNATIONAL EXHIBITION OF 1862.

### SEASON TICKETS.

Members of the Society and others are informed that Season Tickets may be obtained at the Society's house, on application to Mr. S. T. Davenport, the financial officer. Price three guineas and five guineas, the latter also admitting to the Horticultural Gardens and *fetes* during the season.

### GUARANTEE.

The Council beg to announce that the Guarantee Deed is now lying at the Society's House for signature, and they will be much obliged if those gentlemen who have given in their names as Guarantors, as well as others interested in the Exhibition, will make it convenient to call there and attach their signatures to the Document. Signatures for sums amounting in the aggregate to £451,100, have been attached to the Deed.

## INTERNATIONAL EXHIBITION OF 1862.

## LIST OF JURORS IN CLASSES AND SECTIONS.

### Class I.—Mining, Quarrying, Metallurgy, and Mineral Products.

1. Samuel Blackwell, F.G.S., Dudley, Mining Engineer; 2. J. A. C. das Neves Cabral, Portugal, Inspector of Mines; 3. Charles Combes, France, Member of the Institute, Inspector-General, and Director of the School of Mines; 4. Devaux, Belgium, Member of the Department of Science of the Royal Academy of Belgium, Inspector-General of Mines; 5. Lieut.-General Alex. Gerngross, Russia, Director of Mining Department; 6. Sir W. Logan, Canada, Director of the Geological Survey of Canada; 7. Francisco Luxan, Spain, Senator; 8. Sir Roderick Murchison, F.R.S., F.G.S., *Chairman*, London, Director-General of the Geological Survey and of the Government School of Mines, 16, Belgrave-square, S.W.; 9. C. Overweg, Zollverein, Landowner, Letmathe; 10. J. Percy, M.D., F.R.S., F.G.S., London, Professor of Metallurgy to the Government School of Mines, 2, Craven-hill, W.; 11. Arcangelo Scacchi, Italy, Senator; Professor of Mineralogy; 12. Warington W. Smyth, M.A., F.R.S., F.G.S., London, Professor of Mining to the Government School of Mines, 27, Victoria-street, S.W.; 13. Thomas Sopwith, F.R.S., F.G.S., Newcastle, Mining Engineer, 43, Cleveland-square, W.; 14. K. Styffe, Sweden, Director of the Royal Polytechnic Institution, Stockholm; 15. Peter Tunner, Austria, Director of the Imperial Mining School in Leoben; 16. H. Hussey Vivian, M.P., F.G.S., Swansea, Mine Owner, 5, Upper Belgrave-street, S.W.; 17. Nicholas Wood, F.G.S., Newcastle, Mining Engineer.

### Class II.—Chemical Substances and Products and Pharmaceutical Processes.

#### Section A.—*Chemical Products.*

1. Frederick Anthon, Chem. D., Austria, Professor of Chemistry, Prague; 2. Balard, *Chairman*, France, Professor of the College of France and of the Faculty of Science; 3. E. H. von Baumhauer, M.D., Netherlands, Professor of Chemistry in the University of Amsterdam, and Member of the Academy, 56, Brompton-crescent, S.W.; 4. A. Bernays, Ph. D., India, Professor of Chemistry, St. Thomas's Hospital; 5. Chandelon, Belgium, Professor of Chemistry, University of Liége; Member of the Royal Academy of Medicine; 6. E. Frankland, Ph. D., F.R.S., Foreign Secretary to the Chemical Society, 42, Park-road, St. John's-park, Haverstock-hill, N.W.; 7. Professor G. Forchammer, Denmark, Secretary to the Royal Society of Science, Copenhagen; 8. Wm. Gossage, Warrington, Chemical Manufacturer, 2, Oxford-court, Cannon-street, E.C.; 9. T. Graham, F.R.S., London, Master of the Mint, Vice-President of the Chemical Society, 4, Gordon-square, W.C.; 10. A. W. Hofmann, London, F.R.S., Ph. D., President of the Chemical Society; Professor of Chemistry, Government School of Mines, 9, Fitzroy-square, W.; 11. N. Kunheim, Ph. D., Zollverein, Manufacturer, Berlin; 12. A. V. Lourenço, Portugal, Professor of Chemistry at the Polytechnic of Lisbon; 13. Dr. A. Müller, Sweden, Professor of Chemistry at the Royal Agricultural Academy, Stockholm; 14. Raffaele Piria, Italy, Member of the Italian Parliament; late Minister of Public Instruction, Naples; Professor of Chemistry; 15. James Young, F.R.S.E., F.C.S., Edinburgh, Chemical Manufacturer, 25, South-street, Thurloe-square.

#### Section B.—*Medical and Pharmaceutical Products and Processes.*

1. Dr. Wurtz, France, Professor of the Faculty of Medicine; 2. Von Fehling, M.D., Zollverein, Professor of Chemistry at Stuttgart; 3. Daniel Hanbury, F.L.S., London, Pharmaceutical Chemist, 1, Plough-court, Lombard-street, E.C.; 4. Salvatore de Luca, Italy, Professor of Chemistry; 5. T. N. R. Morson, F.L.S., London, Pharmaceutical Chemist, 38, Queen's-square, Bloomsbury, W.C.; 6. J. M. Neligan, M.D., Dublin, Great Western Hotel, W.; 7. Theos. Redwood, M.D., London, Secretary to the Chemical Society and Professor of Pharmacy to the Pharmaceutical Society, 19, Montague-street, Russell-square, W.C.; 8. A. Schroetter, Ph. D., Austria, General Secretary of the Imperial Academy of Science; Professor of Chemistry, Vienna; 9. Robert Warington, F.C.S., London, Vice-President of the Chemical Society, Apothecaries-hall, E.C.

### Class III.—Substances used for Food.

#### Section A.—*Agricultural Produce.*

1. Constantine Ardanaz, Spain; 2. James Buckman, Cirencester, Professor at the Royal Agricultural College, Cirencester, 22, Sussex-place, Regent's-park, N.W.; 3. Buffet, France, late Minister; 4. J. D'Andrade Corvo, Portugal, Professor at the Agricultural Institute, and at

the Polytechnic at Lisbon, Member of the Academy of Science; 5. Elsner Von Gronow, Zollverein, Member of the Royal Board of Agriculture, Kalinowitz; 6. C. Wren Hoskyns, London, Member of the Council of the Royal Agricultural Society, 27, Berkeley-square, W.; 7. Stefano Jacini, Italy, Member of the Italian Parliament, late Minister of Public Works; 8. Jacquemyns, Belgium, Member of the Chamber of Representatives and of the Chamber of Commerce at Ghent; 9. J.W. Larking, Turkey, The Firs, Lee, Kent, S.E.; 10. Chas. Lawson, Edinburgh, Seedsman, 43, Glo'ster-place, Hyde-park, W.; 11. P. Möller, Sweden; 12. Lord Portman, London, President of the Royal Agricultural Society of England, 5, Princes-gate, W.; 13. M. E. Rodocanachi, Greece, Merchant, 3, Gloucester-square, Hyde-park, W.; 14. Nicholas-Tchernayev, Russia, Member of the Scientific Committee of Crown Lands, 58, Brompton-square, S.W.; 15. E. W. Thomson, Canada, President of the Board of Agriculture; 16. Ch. Woolloton, London, Hop Merchant, 246, High-street, Borough, S.E.; 17. Count H. de Zichy, Austria, Land and Mine Owner.

### Section B.—*Drysaltery, Grocery, and Preparations of Food as sold for Consumption.*

1. Boussingault, *Chairman*, France, Member of the Institute, Professor to the Conservatory of Arts and Manufactures; 2. A. Campbell, M.D., India, Superintendent at Darjeeling, Great Western Hotel, W.; 3. James Carey, S. American Republics, Colonial Broker, 36, Mincing-lane, E.C.; 4. E. T. Foord, Ionian Islands, Merchant, 6, Crosby-square, E.C.; 5. F. Hicks, London, Sugar Refiner, 11, Little Alie-street, E.; 6. Jacob, Zollverein, Councillor of Commerce, Halle on Saale; 7. Henry L. Keeling, London, Fruit and Grocery Warehouseman, 3, Monument-yard, E.C.; 8. E. Lankester, M.D., F.R.S., London, Superintendent of Food Collection, South Kensington, 8 Savile-row, W.; 9. H. Letheby, M.B., F.L.S., London, Officer of Health of City of London, 41, Finsbury-square, E.C.; 10. S. Mavrojani, Greece, 26, Gloucester-square, Hyde-park, W.; 11. Baron Riese Stallburg, Austria, Member of Austrian Parliament, Landowner; 12. Adolfo Targioni Tozzetti, Italy, Professor of Zoology, Royal Museum of Natural History, Florence; 13. C. Woodhouse, Mauritius, Colonial Broker, Mincing-lane, E.C.

### Section C.—*Wines, Spirits, Beer, and other Drinks, and Tobacco.*

1. J. S. Bowerbank, F.R.S., London, Distiller, 3, Highbury-grove, N.; 2. Ch. Buxton, M.P., London, Brewer, 7, Grosvenor-crescent, S.W.; 3. Gordon W. Clark, London, Wine Broker, 72, Great Tower-street, E.C.; 4. J. A. Van Eyck, Ph. D., Netherlands, Director of the Palace of Industry in Amsterdam; 5. E. C. Ionides, Greece, Merchant, 51, Inverness-terrace, W.; 6. D. Leiden, Zollverein, Councillor of Commerce, Cologne, Westminster Palace Hotel, S.W.; 7. Monny de Mornay, France, Director of Agriculture in the Ministry of Agriculture, Commerce, and Public Works; 8. Noetzlin-Langmesser, Switzerland, Wine Merchant, Basel; 9. A. H. Novelli, London, 6, Grosvenor-street, W.; 10. A. Odelberg, Sweden; 11. Arthur Otway, Ionian Islands, Army and Navy Club, George-street, Pall-mall, S.W.; 12. George Phillips, London, Principal of Laboratory to the Excise Office, Somerset-house, W.C.; 13. Jos. Prestwich, F.R.S., London, Wine Merchant, 10, Kent-terrace, Regent's-park, N.W.; 14. Marquis-Gen. Emilio Bertone di Sambuy, Italy; 15. Robert Schlumberger, Austria, Member of the Chamber of Commerce, Vienna.

## Class IV.—Animal and Vegetable Substances used in Manufactures.

### Section A.—*Oils, Fats, and Wax, and their Products.*

1. J. Ben Heath, Italy, Italian Consul General; 2. P. J. Kerckhoff, M.D., Netherlands, Professor of Chemistry in the University of Gröningen; 3. S. Marcoran, Ionian Islands; 4. Emmanuel Mavrogordato, Greece, Merchant, 56, Westbourne-terrace; 5. T. J. Miller, M.P., London, Spermaceti Manufacturer, Dorset Wharf, Millbank, S.W.; 6. W. A. Miller, F.R.S., London, Professor of Chemistry, King's College, London, King's College, W.C.; 7. A. Payen, France, Member of the Institute, Professor to the Conservatory of Arts and Manufactures, and Professor to the Central School of Arts and Manufactures; 8. Emil Seybel, Austria, Member of the Chamber of Commerce, Vienna; 9. Stas, Belgium, Member of the Department of Science of the Royal Academy of Belgium; 10. Dr. Stein, Zollverein, Professor, Dresden; 11. T. Thompson, M.D., India, Superintendent of the Botanical-gardens, Calcutta, 5, York-gate, Regent's-park, N.W.; 12. W. W. Williams, London, Soapmaker, 31, Westbourne-park, W.; 13. Geo. Wilson, F.R.S., London, Manager of Price's Patent Candle Works, Wandsworth-common, S.

### Section B.—*Other Animal Substances used in Manufacture.*

1. Capt. C. Bagot, South Australia, 8, Inverness-terrace, W.; 2. Bella, France, Director of the Agricultural Institution of Grignon; 3. Samuel Birchall, New South Wales, Wool Merchant, Gresham Club, E.C.; 4. George Busk, F.R.S., London, Secretary of the Linnean Society, 15, Harley-street, W.; 5. Robert Czilchert, Austria, Landowner; 6. Sir Frederick J. Halliday, K.C.B., India, late Lieut.-Governor of Bengal, 28, Cleveland-square, W.; 7. J. G. Homere, Greece, Merchant, 4, The Terrace, Kensington-gardens-square, W.; 8. J. Jowitt, Queensland, Wool Merchant (James Scott and Co.), 11, King William-street, E.C.; 9. Antonio Marchetti, Italy, Member of the Italian Parliament; 10. J. J. Mechi, London, Alderman, 4, Leadenhall-street, E.C.; 11. P. L. Sclater, F.R.S., London, Secretary of the Zoological Society, 11, Hanover-square, W.; 12. L. Scholler, Zollverein, Privy Councillor of Commerce, Duren; 13. J. Stebut, Russia, Professor of Agriculture in the Agricultural College, Gorigoretsk, 58, Brompton-square, S. W.

### Section C.—*Vegetable Substances used in Manufactures, &c.*

1. T. Archer, F.R.S.E., Edinburgh, Director of Industrial Museum, Edinburgh; 2. Barral, France, Member of the Imperial Society of Agriculture; 3. Robert Fauntleroy, London, Hardwood Merchant, 99, Bunhill-row, Finsbury, E.C.; 4. J. D. Hooker, M.D., F.R.S., V.P.L.S., F.G.S., London, Director Royal Botanic Gardens, Royal Gardens, Kew, S.W.; 5. J. B. Hurlbert, LL.D., Canada; Sir Robert Kane, F.R.S., M.R.I.A., Dublin, Director of Museum of Irish Industry; 7. J. Miers, F.R.S., F.L.S., Brazil, Temple-lodge, Hammersmith, W.; 8. Filippo Parlatore, Italy, Professor of Botany, Royal Museum of Natural History, Florence; 9. W. Henry Peat, South American Republics, 11, Mincing-lane, E.C.; 10. George Peterson, Russia, Member of the Scientific Committee of Crown Lands, and of the Council of Manufactures, 56, Brompton-square, S.W.; 11. R. Riddell, India, late Superintending Surgeon, Nizam's Army, Deccan, 7, The Grove, Clapham, S.; 12. W. W. Saunders, F.R.S., Tasmania, Vice-President of the Linnean Society; 13. Chev. de Schwarz, Austria, *Chairman*, Imperial Councillor, Director of the Austrian Consulate General, Paris; 6, Onslow-crescent, S.W.; 14. M. A. Sevastopoulo, Greece, Merchant, 18, Leinster-gardens, W.; 15. Dr. Thiel, Zollverein.

### Section D.—*Perfumery.*

1. E. Moll, France, Professor at the Conservatory of Arts and Manufactures; 2. W. Odling, M.D., F.R.S., London, Professor of Practical Chemistry, Guy's Hospital, Guy's Hospital, S.E.; 3. Sept. Piesse, London, Distiller of Perfumes, 2, New Bond-street, W.; 4. Eugene Rimmel, London, Perfumer, 96, Strand, W.

## Class V.—Railway Plant, including Locomotives and Carriages.

1. Wm. Paker, C.E., London, Engineer to London and North-Western Railway Company, 63, Gloucester-place,

Hyde-park, W.; 2. G. P. Bidder, C.E., London, late President of the Institution of Civil Engineers, 24, Great George-street, Westminster, S.W.; 3. Flachat, France, Consulting Railway Engineer; 4. James Kitson Leeds, Mayor of Leeds, Manufacturer of Locomotive Engines; 5. Kruger, Zollverein, Director of Royal Machine Factories, Dirschau; 6. J. F. McConnell, Wolverton, late Locomotive Superintendent of the London and North-western Railway Company; 7. F. Spitaels, Belgium; 8. Arch. Sturrock, Doncaster, Locomotive Engineer, Great Northern Railway, G. N. Railway, King's-cross, N.; 9. Duke of Sutherland, *Chairman*, London, Stafford House, S.W.; 10. Col. Yolland, R.E., F.R.S., London, Inspector of Railways, 17, Westbourne-park, W.

### Class VI.—Carriages not connected with Rail or Tram Roads.

1. Jos. Holland, London, Carriage Builder, 254, Oxford-street, W.; 2. H. M. Holmes, Derby, Coach Builder, 38, Margaret-street, Cavendish-square, W.; 3. George Hooper, London, Coach Builder, 28, Haymarket, W.; 4. Genl. Morin, *Chairman*, France, Member of the Institute, Director of the Conservatory of Arts and Manufactures; 5. J. N. Peters, London, Coach Builder, 96, Park-street, Grosvenor-square, W.; 6. Viscount Torrington, London, 4, Warwick-square, S.W.

### Class VII.—Manufacturing Machines and Tools.

#### Section A.—*Machinery employed in Spinning and Weaving.*

1. Boettcher, Zollverein, Professor at the Industrial School, Chemnitz; 2. Callon, France, Chief Engineer to the Imperial Corps of Mines; 3. J. Cheetham, Staleybridge, Cotton Spinner, Reform Club, Pall-mall, S.W.; 4. M. Curtis, Manchester, Machine Maker; 5. Ben. Fothergill, London, Consulting Engineer, 65, Cannon-street, E.C.; 6. Kindt, Belgium, Inspector of Industry for the Minister of the Interior; 7. J. G. Marshall, Leeds, Flax Spinner.

#### Section B.—*Machines and Tools employed in the Manufacture of Wood and Metal.*

1. J. Anderson, Woolwich, Assistant-Superintendent Gun Factories, Royal Arsenal. Woolwich; 2. W. Fairbairn, F.R.S, *Chairman*, Manchester, Engineer; 3. Robt. Mallet, F.R.S., London, Vice-President of the Irish Institution of Civil Engineers, 11, Bridge-street, Westminster, S.W.; 4. Rev. H. Moseley, M.A., F.R.S., Bristol, Canon of Bristol, Council of Military Education, 13, Great George-street, Westminster, S.W.; 5. Dr. Rülmann, Zollverein, Professor in Hanover; 6. Séguier, France, Member of the Institute; 7. J. Whitworth, F.R.S., Manchester, Engineer, Fenton's Hotel, St. James's-street, S.W.

### Class VIII.—Machinery in General.

1. L. R. Bodmer, Switzerland, Consulting Engineer, 1, Lansdowne-villas, Notting-hill, W.; 2. Chevalier de Burg, Austria, Imperial Councillor, President of the Society of Arts and Manufacturers at Vienna; 3. Earl of Caithness, London, 17, Hill-street, Berkeley-square, W.; 4. M. Chevalier, *Chairman*, France, Senator, Member of the Institute; 5. J. Hawkshaw, F.R.S., F.G.S., London, President of the Institution of Civil Engineers, 43, Eaton-place, S.W.; 6. J. Hick, C.E., Bolton, Civil Engineer; 7. J. M. de Ponte Horta, Portugal, Professor of Mathematics at the Polytechnic of Lisbon; 8. W. M. Neilson, C.E., Glasgow, Civil Engineer; 9. John Penn, C.E., London, Mechanical Engineer, Lee, Kent, S.E.; 10. O. Pihl, Norway, Civil Engineer, 29, Upper Berkeley-street, W.; 11. Du Pré, Belgium, Honorary Chief Engineer of Bridges and Roads; 12. W. Macquorn Rankine, Glasgow, Professor of Mechanics in the University of Glasgow; 13. F. B. Taylor, United States, Mechanical Engineer and Designer, 4, South-parade, Chelsea, S.W.; 14. H. Thomas, Zollverein, Manufacturer, Berlin.

### Class IX.—Agricultural and Horticultural Machines and Implements.

1. C. E. Amos, C.E., London, Consulting Engineer to Royal Agricultural Society, The Grove, Southwark, S.E.; 2. Col. Challoner, London, 11, Charles-street, Berkeley-square, W.; 3. C. J. Dannfelt, Sweden, Inspector, Royal Agricultural Academy; 4. G. Devincenzi, Italy, Member of the Italian Parliament, late Minister of Agriculture, Naples, 44, Thurloe-square, S.W.; 5. E. Egan, Austria, Member of the Imperial Agricultural Society; 6. Viscount Eversley, F.G.S., London, 9, Eaton-place, S.W.; 7. J. Gibson, Dalkeith; 8. B. S. Jörgensen, Denmark, Chairman of the Royal Agricultural Society, Denmark; 9. Wellington Lee, United States, Civil Engineer, 17, Norfolk street, W.C.; 10. Lord Talbot de Malahide, F.R.G.S., Dublin, 81, Jermyn-street, S.W.; 11. Hervé Mangon, France, Engineer to the Imperial Corps of Bridges and Roads, Professor at the School of Bridges and Roads; 12. De Mathelin, Belgium, Member of the Upper Council of Agriculture; 13. J. Miller, Falkirk; 14. J. C. Morton, London, Editor of the *Agricultural Gazette*, 41, Wellington-street, W.C.; 15. Sir Joseph Paxton, M.P., F.L.S., London, Engineer and Architect, 7, Pall-mall East, W.; 16. Marquis de Perales, *Chairman*, Spain; 17. Pintus, Zollverein, Manufacturer, Berlin, 38, Sydney-street, S.W.; 18. Sir John Villiers Shelley, Bart., M.P., London, 1, St James-place, S.W.

### Class X.—Civil Engineering, Architectural and Building Contrivances.

#### Section A.—*Civil Engineering and Building Contrivances.*

1. Delesse, France, Engineer to the Imperial Corps of Mines, Professor of the Normal School, President of the Geological Society; 2. J. Kelk, London, contractor, Exhibition-building, W.; 3. Koch, Zollverein, Government and Architectural Councillor, Berlin; 4. Leclerc, Belgium, Inspector of Agriculture and Engineer of Bridges and Roads; 5. Maurice Loehr, Austria, Imperial Councillor of the Board of Trade and Public Works; 6. C. Manby, C.E., London, Hon. Sec. to the Institute of the Civil Engineers; 7. Thomas Page, London, Civil Engineer, Middle Scotland-yard, Westminster, S.W.; 8. Sir J. Rennie, F.R.S., F.G.S., London, Civil Engineer, 5A, Spring-gardens, S.W.; 9. Marquis of Salisbury, K.G., *Chairman*, London, 20, Arlington-street, S.W.; 10. Cesare Valerio, Member of the Italian Parliament.

#### Section B.—*Sanitary Improvements and Constructions.*

1. Neil Arnott, M.D., F.R.S., London, author of Works on Heating and Ventilation, &c., 2, Cumberland-terrace, Regent's park, N.W.; 2. J. W. Bazalgette, C.E., Engineer to Metropolitan Board of Works, Spring-gardens, S.W.; 3. Bommart, France, General Inspector in the Imperial Corps of Bridges and Roads; 4. Sir Joseph Olliffe, London, Physician to British Embassy, Paris; 5. R. Angus Smith, M.D., F.R.S., Manchester, Secretary to the Manchester Literary and Philosophical Society; 6. J. Sutherland, M.D., London, Inspector of Burial-grounds, 41, New Finchley-road, N.W.

#### Section C.—*Objects shown for Architectural Beauty.*

1. Stavros Dilberoglue, Greece, 13, Barnsbury-park, N.; 2. S. L. Donaldson, Ph. D., London, Professor of Architecture, University College, Bolton-gardens, Russell-square, W.C.; 3. Theo. Jordan, Russia, Member of the Imperial Academy of Fine Arts, 12, Brompton-square, S.W.; 4. A. L. J. Meier, N. Germany, Architect, 26, Gloucester-grove West, Old Brompton, S.W.; 5. Gilbert Scott, R.A., London, Architect. 20, Spring-gardens, S.W.; 6. Syd. Smirke, R.A., London, Architect, 79, Grosvenor-street, W.; 7. W. Tite, M.P., F.R.S., London, President of the Royal Society of British Architects, 42, Lowndes-square, S.W.; 8. E. Trélat, France, Professor to the Conservatory of Arts and Manufactures.

### Class XI.—Military Engineering, Armour, and Accoutrements, Ordnance and Small Arms.

#### Section A.—*Clothing and Accoutrements.*

1. Major-Gen. Sir Fred. Abbott, C.B., London, 13, Inverness-terrace, W.; 2. Col. Joseph Hudson, London, Superintendent of the Royal Military Clothing Establishment, 13, Victoria-street, Pimlico, W.; 3. Moisez, France, Commissary-General; 4. Viscount Ranelagh, London, Colonel South Middlesex Volunteers, 7, New Burlington-street, W.; 5. Major Russell, Egypt, 62, Moorgate-street, E.C.; 6. General Paolo Solaroli, Italy, Aide-de-camp of his Majesty, &c.

#### Section B.—*Tents, Camp Equipage, and Military Engineering.*

1. Treuille de Beaulieu, France, Colonel of Artillery, Director of the Central Depôt of Artillery; 2. General Sir J. Burgoyne, Bart., G.C.B., *Chairman*, London, Inspector-General of Fortifications, War Office, Pall-mall, S.W.; 3. Captain Douglas Galton, R.E., F.R.S., London, Assistant Inspector-General of Fortifications, 12, Chester-street, Grosvenor-place, S.W.; 4. Major-Gen. Hon. James Lindsay, M.P., London, 25, Portman-square, W.; 5. Col. Henry Owen, R.E., C.B., Plymouth, Commanding Royal Engineers, Plymouth, 52, Bedford-square, W.C.

#### Section C.—*Arms and Ordnance.*

1. Sir William Armstrong, F.R.S., C.B., London, Superintendent of Royal Gun Factories, Athenæum Club, S.W.; 2. Lieutenant-General Giovanni Cavalli, Italy; 3. General Guiod, France, Commander of the Artillery of the 1st Division; 4. General the Hon. A. Gordon, C.B., F.R.G.S., London, General in Command, Curragh Camp, 7, Argyll-street, W.; 5, Major-General Hay, London, Inspector of Musketry at Hythe, United Service Club, Pall Mall, S.W.; 6. Colonel Messoud Bey, Turkey; 7. Micheels, Belgium, Lieutent-Colonel of Artillery; Sub-Inspector of the Manufacture of Arms; 8. Nicholas Novitzky, Russia, Colonel of the Russian Imperial Guards, 27, Alfred-place, S.W.; 9. Westley Richards, Birmingham, Rifle-maker, 39, St. James's-place, S.W.; 10. Col. St. George, C.B., R.A., Woolwich, President Ordnance Select Committee, 11, Rutland-gate, S.W.; 11. Lord Vernon, London, 12, Great Marlborough-street, W.; 12. Weyersberg, Zollverein, Manufacturer, Solingen.

### Class XII.—Naval Architecture, including Ship's Tackle.

#### Section A.—*Ships for Purposes of War and Commerce.*

1. Rear-Admiral Fitzroy, F.R.S., London, Chief of Meteorological Department, Board of Trade, 38, Onslow-square, S.W.; 2. Rear-Admiral P. Lisiansky, Russia, Imperial Russian Navy; 3. Robert Napier, *Chairman*, Glasgow, Iron Ship Builder, 5, Montague-place, W.C.; 4. Pâris, France, Rear-Admiral; 5. J. D'A. Samuda, London, Ship Builder, 7, Gloucester-square, Hyde-park, W.; 6. Isaac Watts, C.B., London, Chief Constructor of the Navy, 8, Horsley-place Villas, Paddington, W.

#### Section B.—*Boats, Barges, and Vessels for Amusement.*

1. Right Hon. Milner Gibson, M.P., London, President of the Board of Trade, 3, Hyde-park-place, W.; 2. Sir W. Snow Harris, F.R.S., Plymouth; 3. Perdonnet, France, Superintendent of Railways; Professor to the Central School of Arts and Manufactures; 4. Rear-Admiral Washington, F.R.S., London, Hydrographer to the Admiralty, 7, Oxford-square, Hyde-park, W.

#### Section C.—*Ship's Tackle and Rigging.*

1. Clapeyron, France, Member of the Institute; Engineer-in-Chief to the Imperial Corps of Mines; Professor to the School of Bridges and Roads; 2. H. D. Cunningham, F.R.G.S., Portsmouth, Union Club, Trafalgar-square, W.C.; 3. W. S. Lindsay, M.P., London, Ship owner, 8, Austin Friars, E.C.; 4. Rear-Admiral R. S Robinson, London, Controller of the Navy, 61, Eaton-place, S.W.

### Class XIII.—Philosophical Instruments and Processes depending on their Use.

1. Sir David Brewster, K.H., F.R.S., Edinburgh, Principal of Edinburgh University; 2. Charles Brooke, F.R.S., London, Surgeon to Westminster Hospital, 16, Fitzroy-square, W.; 3. Dr. Dove, *Chairman*, Zollverein, Professor of Natural Philosophy and Principal of the Academy of Sciences, Berlin; 4. J. P. Gassiott, F.R.S., London, Wine Merchant, Clapham-common, S.; 5. James Glaisher, F.R.S., London, Superintendent of the Meteorological and Magnetical Department, Greenwich Observatory, 1, Dartmouth-place, Blackheath, S.E.; 6. Colonel Sir H. James, R.E., F.R.S., Southampton, Superintendent of Ordnance Survey; 7. G. Karsten, Denmark, Professor, Kiel; 8. Edouard Kraft, Austria, Member of the Council of Civil Engineers, Vienna; 9. Mathieu, France, Member of the Institute, and of the Bureau of Longitude; Examiner at the Polytechnic; 10. Carlo Matteucci, Italy, Senator; 11. Major-General Sabine, R.A., F.R.S., London, President of the Royal Society, 13, Ashley-place, Westminster, S.W.; 12. Wm. Thomson, F.R.S., LL.D., Professor of Natural Philosophy, University of Glasgow; 13. C. Wheatstone, F.R.S., London, Professor of Experimental Philosophy, King's College, 7, Chester-terrace, Regent's-park, N.W.

### Class XIV.—Photography and Photographic Apparatus.

1. H. W. Diamond, M.D., London, Twickenham-house, Twickenham, S.W.; 2. A. F. J. Claudet, F.R.S., London, Photographer, 11, Gloucester-road, Regent's-park, N.W.; 3. Baron Gros, *Chairman*, France, Senator; 4. Lord Henry Lennox, M.P., London, 51, Portland-place, W.; 5. C. T. Thompson, London, Official Photographer, Science and Art Department, South Kensington Museum, W.; 6. J. Tyndall, Ph. D., F.R.S., London, Professor of Physics, Royal Institution, Albemarle-street, W.

### Class XV.—Horological Instruments.

1. Dr. Frick, Zollverein, Professor of Physics, Freiburg; 2. Ch. Frodsham, London, Chronometer Maker, 84, Strand, W.C.; 3. Rt. Haswell, London, Watch Tool Maker, 49, Spencer-street, Clerkenwell, E.C.; 4. E. D. Johnson, London, Chronometer Maker, 9, Wilmington-square, W.C.; 5. Laugier, France, Member of the Institute and of the Bureau of Longitudes; 6. Sylvain Mairet, Switzerland, Watchmaker, Lôcle; 7. Rear-Admiral Manners, F.R.S.A., 8, Henrietta-street, Cavendish-square, S.W.; 8. Viscount de Villa Maior, *Chairman*, Portugal, Director-General of the Agricultural Institute; Professor of Chemistry at the Polytechnic of Lisbon, and Member of the Academy of Science, 91, Sloane-street, S.W.; 9. Lord Wrottesley, F.R.S., London, late President of the Royal Society, 1, Albemarle-street, W.

### Class XVI.—Musical Instruments.

1. W. Sterndale Bennett, Mus. D., London, Professor of Music, University of Cambridge, 50, Inverness-terrace, W.; 2. J. R. Black, M.D., United States, 23, Sumner-place, S.W.; 3. Th. Böhm, Zollverein, Court Musician, Munich; 4. Right Hon. Sir Geo. Clerk, F.R.S., *Chairman*, Edinburgh, Chairman of Royal Academy of Music, 43, Eaton-square, S.W.; 5. Fétis, Belgium, Member of the Department of Fine Art of the Royal Academy of Belgium, Director of the Royal Conservatory of Music; 6. Lissajous, France, Professor of Physics to the Lyceum of St. Louis; 7. Sir F. Gore Ouseley, Bart., Mus. D., Professor of Music, University of Oxford; 8. Ernst Pauer, Austria, Professor of Music, 3, Cranley-place, S.W.; 9. Wm. Pole, Mus. B., F.R.S., London, Professor of Civil Engineering, University of London, 3, Storey's-gate,

Westminster, S.W.; 10. Earl of Wilton, G.C.H., London, 7, Grosvenor-square, W.; 11. Henry Wylde, Mus. D., London, Professor at the Royal Academy of Music, 6, Burwood-place, Hyde-park, W.

### Class XVII.—Surgical Instruments.

1. Thos. Bell, F.R.S., London, Vice-President of the Royal Society, Athenæum Club, S.W.; 2. Wm. Bowman, F.R.S., London, Surgeon to King's College Hospital, 5, Clifford-street, W.; 3. Arthur Farre, M.D., F.R.S., London, Physician for Diseases of Women and Children to King's College Hospital, 12, Hertford-street, Mayfair, W.; 4. F. Seymour Haden, F.R.C.S., London, Surgeon, 62, Sloane-street, S.W.; 5. James Luke, F.R.S., London, Consulting Surgeon, London Hospital, 3, Broad-street-buildings, E.C.; 6. Nélaton, France, Professor to the Faculty of Medicine; 7. James Syme, F.R.S.E., Edinburgh, *Chairman*, Professor of Clinical Surgery, University of Edinburgh.

### Class XVII.—Cotton.

1. Henry Ashworth, Bolton, President of the Manchester Chamber of Commerce, Fenton's Hotel, St. James's-street, S.W.; 2. Thos. Bazley, M.P., *Chairman*, Manchester, Calico Printer, 3A, King-street, St. James's, S.W.; 3. Sir James Campbell, Glasgow, Warehouseman; 4. Dolfus, France, Manufacturer; 5. Max. Dormitzer, Austria, President of the Chamber of Commerce, Prague; 6. Duhayon-Brunfaut, Belgium, Manufacturer and Judge of the Chamber of Commerce at Brussels; 7. E. Knapp, Zollverein, Manufacturer, Betzingen; 8. J. Murray, Manchester, Cotton Spinner, 16, Bryanstone-square, W.; 9. E. Loria, Egypt, Merchant, 32, Pelham-street, S.W.; 10. Wetter-Müller, Switzerland, Banker, St. Gall; 11. Alex. Scherer, Russia, Member of the Council of Manufactures; 12. Giovanni Vonwiller, Italy.

### Class XIX.—Flax and Hemp.

1. M. Alcan, France, Professor at the Conservatory of Arts and Manufactures, 32, Ovington-square, S.W.; 2. Erskine Beveridge, Dunfermline, Flax Manufacturer, 15, Langham-street, Portland-place, W.; 3. Marquis Luigi Cusani, Italy; 4. Wm. Charley, Belfast, Linen Merchant; 5. Ch. de Brouckere, Belgium, President of the Chamber of Commerce at Roulers, Member of the Upper Council of Industry; 6. G. Mevissen, *Chairman*, Zollverein, Privy Councillor of Commerce, Cologne, Westminster Palace Hotel, S.W.; 7. J. Moir, Dundee, Flax Spinner; 8. C. Oberleithner, Austria, Manufacturer; 9. Hon. Fred. Smyth, United States, formerly Member of the Senate of New Hampshire.

### Class XX.—Silk and Velvet.

1. Henry Brocklehurst, Macclesfield Velvet Manufacturer, 31, Milk-street, Cheapside, E.C.; 2. Charles Diggelmann, Switzerland, Silk Warehouseman; 3. Arlès-Dufour, *Chairman*, France, Member of the Chamber of Commerce at Lyons; 4. H. W. Freeland, M.P., Turkey, Athenæum Club, S.W.; 5. Anton Harpke, Austria, Member of the Chamber of Commerce at Vienna; 6. W. S. Leaf, London, Silk Warehouseman, 39, Old Change, E.C.; 7. S. W. Lewis, London, Silk Mercer, 193, Regent-street, W.; 8. Jose Reig, Spain; 9. Filippo Sessa, Italy, Manufacturer, Westminster Palace Hotel, S.W.; 10. Baron Von Diergardt, Zollverein, Privy Councillor of Commerce, Vierssen; 11. Thomas Winkworth, London, late Silk Manufacturer, 7, Sussex-place, Canonbury, N.

### Class XXI.—Woollen and Worsted, including Mixed Fabrics generally.

1. R. Atkinson, Dublin, late Lord Mayor of Dublin, Poplin Manufacturer, 1, Cambridge-place, Victoria-road, W.; 2. Alex. Boutovsky, Russia, Director of the Department of Manufactures and Inland Trade; 3. Wm. Clabburn, Norwich, Shawl Manufacturer; 4. H. Hudson, Leeds, Woollen Merchant, 7, Harley-street, Cavendish-square; 5. E. Huth, Huddersfield, Foreign Merchant; 6. Larsonnier, France, manufacturer, Member of Chamber of Commerce of Paris; 7. Laoureux, Belgium, Member of the Senate; 8. F. Marbach, Saxony, Manufacturer, Chemnitz; 9. Chs. Offermann, *Chairman*, Austria, Manufacturer, at Brünn, 24, Charles-street, St. James's-square; 10. C. Palmstedt, Sweden, Professor; 11. E. Prætorius, Prussia, Councillor of Commerce, Berlin; 12. J. W. Redhouse, F.R.A.S., Turkey, 18, Garway-road, Bayswater, W.; 13. H. W. Ripley, Bradford, Chairman of the Bradford Chamber of Commerce, 9, St. George's-terrace, Hyde-park; 14. Gregorio Sella, Italy; 15. E. E. Vreede, Netherlands, Woollen Manufacturer; 16. H. S. Way, London, Woollen Warehouseman, 127, Cheapside, E.C.

### Class XXII.—Carpets.

1. Badin, France, Director of Imperial Manufactures at Gobelin and Beauvais, 3, George-street, Portman-square; 2. J. Brinton, Kidderminster, Carpet Manufacturer, 90, Newgate-street, E.C.; 3. P. Graham, London, Upholsterer, 33, Oxford-street, W.; 4. H. L. Lapworth, London, Carpet Manufacturer, 22, Old Bond-street, W.; 5. Sylvain van de Weyer, *Chairman*, Belgium, Envoy Extraordinary and Minister Plenipotentiary, 50, Portland-place, W.; 6. W. Whitwell, Kendal, Carpet Manufacturer, 26, Gloucester-place, Dorset-square, N.W.

### Class XXIII.—Woven, Spun, Felted, and Laid Fabrics, when shown as Specimens of Printing and Dyeing.

1. Pompejus Bolley, Ph.D., *Chairman*, Switzerland, Professor of Chemistry at Zurich; 2. Crace Calvert, F.R.S., Ph.D., Manchester, Honorary Professor of Chemistry to the Manchester Royal Institution; 3. R. Dalglish, M.P., Glasgow, Calico Printer, 2, Queen's-gate-terrace, W. 4. Alexander Harvey, Glasgow, Dyer; 5. F. Leitenberger, Austria, Manufacturer; 6. J. Mercer, F.R.S., F.C.S., Accrington, Calico Printer; 7. A. Neild, Manchester, Calico Printer; 8. Persoz, France, Professor at the Conservatory of Arts and Manufactures; 9. M. Reichenheim, Zollverein, Manufacturer, Berlin; 10. J. S. Stern, Manchester, Merchant, Fenton's Hotel, St. James's-street, S.W.

### Class XXIV.—Tapestry, Lace, and Embroidery.

1. Aubry, France, Merchant, late member of the Tribunal of Commerce; 2. Dan. Biddle, London, Lace Manufacturer, 68, Finchley New-road, Hampstead, N.W.; 3. Richard Birkin, Nottingham, Lace Manufacturer; 4. J. Fisher, London, late Lace Manufacturer, 60, St. James's-street, S.W.; 5. F. Fortamps, *Chairman*, Belgium, Member of the Senate, 27, Ovington-square, S.W.; 6. Rudolph Laporta, Austria, Manufacturer; 7. Prince St. Giuseppe of Pandolfina, Italy, Senator; 8. Major-Gen. Sir H. Rawlinson, K.C.B., F.R.S., Turkey, 1, Hill-street, Berkeley-square, W.; 9. Richter, Zollverein, Inspector of Industrial Schools, Schneeberg; 20. E. Stadler, Switzerland, Commission Merchant, 2, Lawrence-lane, E.C.; 11. Col. Sykes, M.P., F.R.S., India, Chairman of the East India Company, 47, Albion-street, Hyde-park, W.

### Class XXV.—Furs, Feathers, and Hair.

#### Section A.—*Skins and Furs.*

1. Duke of Casigliano, Italy; 2. E. Ellice, M.P., London, Deputy Governor of the Hudson's Bay Company, 18, Arlington-street, S.W.; 3. Gabl. Kamensky, *Chairman*, Russia, Russian Commissioner in London, 33, Victoria-road, Kensington-gore, W.; 4. J. A. Nicholay, London, Furrier, 82, Oxford-street, W.; 5. Guillme. Petit, France, Manufacturer; 6. E. B. Roberts, London, Furrier to the Hudson's Bay Company, 239, Regent-street, W.

#### Section B.—*Feathers and Manufactures from Hair.*

1. Augustus Altgelt, Zollverein, Government and Ar-

chitectural Councillor, Berlin; 2. Chas. Duncum, London. Artificial Florist, 16, Wigmore-street, W.; Henri Gillett, France, Manufacturer, President of the Chamber of Commerce of Bar-le-Duc; 4. G. B. Kent, London, Brush Manufacturer, 11, Great Marlborough-street, W.; 5. C. Nightingale, London, Feather and Hair Merchant, 88, Gloucester-place, Portman-square, W.

## Class XXVI.—Leather, including Saddlery and Harness.

### Section A.—*Leather, and Manufactures generally made of Leather.*

1. M. Blackmore, London, late Leather Dresser, East Moulsey, S.W.; 2. Fauler, France, late Manufacturer, Member of the Chamber of Commerce, Paris; 3. J. George, London, Wholesale Leather Factor, 4, Skinner-street, E.C.; 4. Lang-Gores, Zollverein, Manufacturer, Malmedy; 5. Wm. Linley, London, Leather Factor, 30, West Smithfield, E.C.; 6. Major-Gen. Count E. Martini di Cigala, Italy, Aide-de-camp to His Majesty; 7. Piret Pauchet, Belgium; 8. Moritz Pollak, Austria, Manufacturer and Merchant; 9. Jean Reymod, Switzerland, late Currier, Morges.

### Section B.—*Saddlery and Harness.*

1. Earl of Bessborough, *Chairman*, London, Master of the Buckhounds, 40, Charles-street, Berkeley-square, W.; 2. Hy. Brace, Walsall, Wholesale Saddler, 3, Norfolk-road, St. John's Wood, N.W.; 3. C. Joyce, Egypt, Merchant, 32, Moorgate-street, E.C.; 4. Leblanc, France, Late Officer of the Imperial Navy; 5. Ben. Long, Manchester, Saddler, Brent-house, Hendon, N.W.

## Class XXVII.—Articles of Clothing.

### Section A.—*Hats and Caps.*

1. Cavaré, France, late Merchant; 2. George Christy, London, Hatter, 35, Gracechurch-street, E.C.; 3. S. B. Eveleigh, Manchester, Hat Manufacturer, 4, Hereford-square, S.W.; 4. Aloys Isler, Switzerland, Straw Manufacturer, Wildegg; 5. Wm. Swinscow, London, Furrier, Loman street, Southwark, S.E.

### Section B.—*Bonnets and General Millinery.*

1. Thomas Brown, London, Wholesale Milliner, 85, Wood street, Cheapside, E.C.; 2. Henry Gregory, London, Straw Bonnet Maker, 15, Aldermanbury, E.C.; 3. Alphonse Payen, France, Merchant, Member of the Chamber of Commerce of Paris; 4. Samuel Sugden, London, Warehouseman, 12, Aldermanbury, E.C.

### Section C.—*Hosiery, Gloves, and Clothing in general.*

1. J. D. Allcroft, London, Glover, 55, Porchester-terrace, W.; 2. J. R. Allen, Nottingham, Hosier, 8, King Edward-street, E.C.; 3. F. Esche, Zollverein, Manufacturer, Limbach; 4. Gaussen, France, late Manufacturer; 5. Joseph Gunkel, *Chairman*, Austria, Member of the Chamber of Commerce, Vienna; 6. J. Hunter, London, Robe Maker to the Queen, and Tailor, 34, Maddox-street, W.; 7. Luigi Scalia, Italy, Member of the Italian Parliament; S. Vanderborght, Belgium, Manufacturer.

### Section D.—*Boots and Shoes.*

1. J. K. Bowley, London, Bootmaker, 53, Charing-cross, W.C.; 2. R. D. Box, London, Shoemaker, 187, Regent-street, W.; 3. Gervais (Caen), France, Director of the Upper School of Commerce; 4. Huber, Zollverein, Director of the Chamber of Commerce of Stuttgart; 5. Jas. Medwin, London, Bootmaker, 86, Regent street, W.; 6. Fred. Suess, Austria, Manufacturer.

## Class XXVIII.—Paper, Stationery, Printing, and Bookbinding.

### Section A.—*Paper, Card, and Millboard.*

1. Bart. Cini, Italy, Member of the Italian Parliament 2. Charles Cowan, F.R.S.E., Edinburgh, Paper Manufacturer, 11, Sussex-place, S. Kensington, W.; 3. E. Hoesch, Zollverein; 4. Wyndham S. Portal, Basingstoke, Paper Manufacturer, 3, Wilton-crescent, Belgrave-square, S.W.; 5. Sainte-Claire-Deville, France, Member of the Institute, Professor at the Normal School, 3, Byng-place, Gordon-square, W.C.; 6. W. R. Spicer, London, Wholesale Stationer, 19, New Bridge-street, E.C.

### Section B.—*Stationery.*

1. Warren de la Rue, F.R.S., F.C.S., London, Ornamental Stationer, 110, Bunhill-row, E.C.; 2. List, Zollverein, Manufacturer, Frankfort-on-the-Maine; 3. Victor Masson, France, Judge to the Tribunal of Commerce of the Seine, 21, Pelham-crescent, S.W.; 4. Earl Stanhope, F.R.S., *Chairman*, London, 31, Grosvenor-place-houses, S.W.; 5. H. Stevens, F.S.A., F.R.G.S., United States, Literary Agent, 4, Trafalgar-square; 6. C. Venables, Bath, late Papermaker, 42, Cambridge-terrace, W.

### Section C.—*Plate, Letterpress, and other Modes of Printing.*

1. Adam Black, M.P., London, 24, James-street, Buckingham-gate, S.W.; 2. George Clowes, London, Printer, Duke-street, Stamford-street, S.; 3. Giuseppe La Farina, Italy, Member of the Italian Parliament, Councillor of State, late Minister in Sicily; 4. Ch. Girardet, Austria. Manufacturer; 5. Jamar, Belgium, Member of the Chamber of Representatives, 21, Norfolk-street, W.C.; 6. H. Korn, Zollverein, Bookseller and Printer, Breslau; 7. Laboulaye, France, late Type-founder; 8. W. Spottiswoode, F.R.S., London, Her Majesty's Printer, 19, Chester-street, W.

### Section D.—*Bookbinding.*

1. J. Gibson Craig, W.S.. Edinburgh; 2. Ch. Reed, F.S.A., London, Printer, Foundry, Fann-street, E.C.; 2. Jas. Toovey, London, Bookseller and Publisher. 177, Piccadilly, W.; 4. L. Wolowski, France, Member of the Institute, Professor to the Conservatory of Arts and Manufactures, 27, Duke-street, St. James's, S.W.

## Class XXIX.—Educational Works and Appliances.

### Section A.—*Books and Maps.*

1. Hon. and Rev. S. Best, London; 2. Robt. Chambers, F.R.S.E., Edinbugh, Editor and Publisher, 6, Hall-road, St. John's-wood, N.W.; 3. Gottfried Müller, Austria, Professor, Hermanstadt; 4. Antonio Panizzi, D.C.L., Italy, Librarian, British Museum; 5. Robert, France, Master of Appeals to the Council of State; 6. Nassau Senior, London, 13, Hyde-park-gate, W.

### Section B.—*School Fittings, Furniture, and Apparatus.*

1. Rt. Hon. C. B. Adderley, M.P., London, 35, Eaton-place, S.W.; 2. Marquis Gustavo Benso di Cavour, *Chairman*, Member, Italian Parliament, 44, Thurloe-square, S.W.; 3. Hy. Chester, Esq., London, late Secretary to Committee of Council of Education, 63, Rutland-gate, W.; 4. Rev. M. Mitchell, London, one of H.M.'s Inspectors of Schools, Education Department, Council Office, S.W.; 5. Léon Say, France; 6. Sir J. K. Shuttleworth, F.R.G.S., F.G.S., London, 38, Gloucester-square, Hyde-park, W.

### Section C.—*Appliances for Physical Training, including Toys and Games.*

1. E. Chadwick, C.B., London, 5, Montague-villas, Richmond, S.W.; 2. Viscount Enfield, M.P., London, 7, Charles-street, Berkeley-square, W.; 3. Flandin, France, Councillor of State; 4. R. Monckton Milnes, M.P., London, 16, Upper Brook-street, W.; 5. Dr. Rud. Wagener, Zollverein, Professor, Würzburg.

### Section D.—*Specimens and Illustrations of Natural History and Physical Science.*

1. Cloquet, France, Member of the Institute, Professor of Medicine; 2. Rev. B. M. Cowie, B.D., London, one of

Her Majesty's Inspectors of Schools, 62, Queen's-gardens, W.; 3. J. E. Gray, Ph. D., F.R.S., Keeper of Zoological Collection, British Museum, W.C.; 4. N. S. Maskelyne, London, Keeper of Mineralogy, British Museum, W.C.

### Class XXX.—Furniture and Upholstery, including Paperhangings and Upholstery.

#### Section A.—*Furniture and Upholstery.*

1. Dr. Beeg, *Chairman*, Zollverein, Principal of the School of Industry and Commerce, Fürth, 48, Brompton-square, S.W.; 2. Lord de l'Isle, London, St. George's Hotel, Albemarle-street, W.; 3. Demanet, Belgium, Member of the Department of Fine Arts of the Royal Academy, Belgium; 4. Count Demetrio Finocchietti, Italy, Vice-Governor of the Royal Palaces at Florence; 44, Thurloe-square; 5. Wm. Holland, London, Upholsterer, 28, Mount-street, Grosvenor-square, W.; 6. John Jackson, London, Carton Pierre Manufacturer, 49, Rathbone-place, W.; 7. M. Markert, Austria, Manufacturer, Vienna; 8. L. Piglhein, North Germany, Cabinet-maker, 15, Montpellier-street, S.W.; 9. J. H. Pollen, Rome, 11, Pembridge-crescent, W.; 10. Du Sommerard, France, Director of the Museum of Cluny, 3, Ovington-square, S.W.; 11. Sir C. Trevelyan, K.C.B., India, 8, Grosvenor-crescent, Belgrave-square, S.W.; 12. Digby Wyatt, F.S.A., London, Vice-President, Royal Institution of British Architects, 37, Tavistock-place, W.C.

#### Section B.—*Paperhangings and General Decoration.*

1. Lord Ashburton, F.R.S., London, President of the Royal Geographical Society, 82, Piccadilly, W.; 2. Marquis F. A. Gattinara di Breme, Master of the Ceremonies, Director-General of the Royal Albertine Academy, Senator, &c.; 3. J. G. Crace, London, Decorator, 14, Wigmore-street, W.; 4. Jos. Forguignon, North Germany, Upholsterer, 12, Greek-street, W.; 5. A. J. Beresford Hope, M.A., London, 1, Connaught-terrace, Hyde-park, W.; 6. Owen Jones, London, Architect, 9, Argyll-place, Regent-street, W.; 7. Prosper Mérimée, France, Senator, Member of the Institute.

### Class XXXI.—Hardware.

#### Section A.—*Manufactures in Iron.*

1. J. G. Appold, F.R.S., London, Fur Skin Dyer, 23, Wilson-street, Finsbury, E.C.; 2. William Bird, London, Iron and Tin-plate Merchant, 3, Laurence Pountney-hill, E.C.; 3. Giulio Curioni, Italy, Secretary to the Royal Lombard Institute of Sciences: 4. Daubrée, France, Engineer in Chief to the Imperial Corps of Mines; Professor to the Museum of Natural History; 5. Chev. de Fridau, Austria, Proprietor of Iron and Steel Works, Styria; 6. A. Grill, Sweden, Director of Mines; 7. H. E. Hoole, Sheffield, Stove-grate Manufacturer, 14, Percy-street, Rathbone-place, W.; 8. J. Oakes, Alfreton, Ironmaster; 9. Dr. D. S. Price, F.C.S., London, 26, Great George-street, Westminster, S.W.; 10. L. Ravené, Jun., Zollverein, Manufacturer, Berlin; 11. George Shaw, Birmingham, Patent Agent, Old Hummums Hotel, W.C.; 12. Trasenster, Belgium, Professor at the University of Liége.

#### Section B.—*Manufactures in Brass and Copper.*

1. S. Buckley, Birmingham, Merchant; 2. E. Gem, Birmingham, Merchant; 3. P. C. Hardwick, London, Architect, 21, Cavendish-square, W.; 4. De Longpérier, France, Member of the Institute; Conservator of the Museum of the Louvre; 5. Ferdinand Stamm, Ph. D., Austria, Member of the Austrian Parliament; 6. Dr. von Steinbeis, *Chairman*, Zollverein, Director of the Royal Central Board of Industry and Commerce, Stuttgart; 7. A. Tylor, London, Brass Founder, Warwick-lane, Newgate-street, E.C.

#### Section C.—*Manufactures in Lead, Tin, and Zinc, and General Hardware.*

1. Robert Fletcher, Birmingham, Merchant; 2. Goldenburg, France, Manufacturer; 3. W. A. Rose, London, Alderman, Lead Merchant, Queenhithe, E.C.; 4. G. Stobwasser, Zollverein, Manufacturer, Berlin; 5. J. S. Wyon, London, Chief Engraver of H.M.'s Seals, 287, Regent-street, W.

### Class XXXII.—Steel.

#### Section A.—*Steel Manufactures.*

1. J. Brown, Sheffield, Mayor of Sheffield, Great Northern Hotel, King's-cross, N.; 2. Frémy, France, Professor at the Museum of Natural History, and at the Polytechnic; 3. Robert Jackson, Sheffield, Steel Manufacturer, 26, Palace-gardens-terrace, W.; 4. Thomas Jessop, Sheffield, Steel Manufacturer, 26, Palace-gardens-terrace, W.; 5. Dr. Karmarsh, Zollverein, Director of the Royal Polytechnic School, Hanover, 26, Palace-gardens-terrace, W.

#### Section B.—*Cutlery and Edge Tools.*

1. Henry Atkin, Esq., London, Merchant, late Master Cutler, 32, New Broad-street, E.C.; 2. De Hennezel, France, Engineer to the Imperial Corps of Mines. 3. M. Hunter, jun., Sheffield, Cutler, 67, King William-street, E.C.; 4. Wm. Matthews, Sheffield, Past Master Cutler, 46, Salisbury-square, Fleet-street, E.C.; 5. Basil Roshkof, Russia, Colonel of Mining Engineers; 6. F. Wertheim, Austria, Vice-President of the Chamber of Commerce, Vienna; 7. Lord Wharncliffe, *Chairman*, London, 15, Curzon-street, W.

### Class XXXIII.—Works in Precious Metals and their Imitations, and Jewellery.

1. Tommaso Corsi, Italy, Member of the Italian Parliament, late Minister of Agriculture, Industry, and Commerce; 2. C. W. S. Deakin, Birmingham, Merchant; 3. A. M. Dowleans, India, Secretary to the Bengal Central Committee for the Exhibition; 4. Fred. Elkington, Birmingham, Silver Plater, 97, Gloucester-terrace, Hyde-park, W.; 5. Fossin, France, late Judge to the Tribunal of Commerce, 5, Thurloe-square, Brompton, S.W.; 6. Fred. Friedland, Austria, Member of the Chamber of Commerce, Prague; 7. J. Hunt, London, Goldsmith, 156, New Bond-street, W.; 8. A. Kaiser, Zollverein, Manufacurer, Pforzheim; 9. H. J. Lias, London, Prime Warden, Goldsmiths' Company, 18, Regent's-park-terrace, Gloucester-gate, N.W.; 10. W. Maskell, M.A., Bristol, 24, Onslow-square, S.W.; 11. Lord Stratford de Redcliffe, G.C.B., Chairman, Turkey, 29*a*, Grosvenor-square, W.; 12. Rev. Montague Taylor, London, 42, Gravenhill-gardens, W.

### Class XXXIV.—Glass.

#### Section A.—*Stained Glass and Glass used for Decoration.*

1. J. R. Clayton, London, Glass Stainer, 331, Regent-street, W.; 2. W. Dyce, R.A., London, Streatham, S.; 3. Sir Philip De M. Grey Egerton, M.P., F.R.S., London, 28B, Albemarle-street, W.; 4. J. R. Herbert, R.A., London, 7, Grove-end-place, N.W.; 5. E. Peligoz, France, Member of the Institute; Professor at the Conservatory of Arts and Manufactures, and at the Central School of Arts and Manufactures.

#### Section B.—*Glass for Household Use and Fancy Purposes.*

1. R. L. Chance, Birmingham, Glass Manufacturer, 51, Wimpole-street, Cavendish-square, W.; 2. Alf. Copeland, London, Glass Manufacturer, 160, New Bond-street, W.; 3. Jas. Hartley, Sunderland, Glass Manufacturer; 4. Jonet, Belgium, Member for the Chamber of Commerce at Charleroi; 5. Apsley Pellatt, London, late Glass Manufacturer, Knowle-green, Staines; 6, Pelouze, *Chairman*, France, Member of the Institute; President of the Commission of Money and Medals; 7; Fred. Schmitt, Austria, Secretary of the Statistical Department, Board

of Trade, Vienna; 8. F. Wisthoff, Zollverein, Manufacturer, Kœnigs-Stelle.

### Class XXXV.—Pottery.

1. Marquis D'Azeglio, Italy, Envoy Extraordinary and Minister Plenipotentiary of Italy; 2. Thomas Battam, F.S.A., London, 5, Aubrey-villas, Holland-park, W.; 3. Right Hon. W. E. Gladstone, M.P., *Chairman*, London, Chancellor of the Exchequer, 11, Carlton-house-terrace, S.W.; 4. Sir Thos. Gresley, Bart., Burton-on-Trent; 5. J. Marryat, London, Banker, 17, Upper Eccleston place, Pimlico, S.W.; 6. Regnault, France, Member of the Institute, Professor of the College of France, Engineer-in-Chief, Imperial Corps of Mines, Director of the Imperial Manufactory at Sèvres, &c.; 7. J. G. Robinson, London, Superintendent of Art Collection, Department of Science and Art, South Kensington Museum, W.; 8. Chr. Fischer, Zollverein, China Manufacturer; 9. J. Webb, London, 11, Grafton street, Berkeley-square, W.

### Class XXXVI.—Dressing Cases and Despatch Boxes and Travelling Cases.

1. Chas. Bazin, London, Dressing Case Manufacturer, 112, Regent-street, W; 2. Beriah Botfield, M.P., F.R.S., London, 5, Grosvenor-square, W.; 3. Fink, Zollverein, Councillor of Commerce, Darmstadt; 4. Lord Harris, K.S.I., London, late Governor of Madras, 28, South street, Grosvenor-square, W.; 5. Sir Thos. Phillips, F.G.S., *Chairman*, London, Vice-President and Chairman of the Council of the Society of Arts, 11, King's Bench Walk, Temple, E.C.; 6. N. Rondot, France, Merchant; 7. F. West, London, Cutler, 1, St. James's-street, S.W.

## A NEW PROJECTILE FORCE.

By Thomas M. Meschin, D.C.L., F.S.A., of the Inner Temple, Barrister.

Water may be decomposed into its constituent elements, oxygen and hydrogen gases, either by voltaic electricity, by common electricity, by magneto-electricity, or by thermo-electricity.

1st. By Voltaic Electricity.—When the electrodes of a voltaic battery are brought near each other, in acidulated water, or, in other words, when water is made part of a galvanic circuit, so that the current of electricity passes through it, decomposition ensues—its constituent elements, oxygen and hydrogen gas, are evolved at the electrodes.

2nd. By Frictional Electricity.—Water may also be decomposed by passing a succession of discharges of common electricity through it. This was accomplished so early as 1789, by Messrs. Dieman Paetz and Von Troostwych. Professor Faraday and Mr. Goodman have also succeeded in obtaining true electro-polar decomposition of water by the action of frictional electricity.

3rd. By Magneto-Electricity.—Water can also be decomposed by a magneto-electric apparatus, for if it be made part of the circuit, as often as the circuit is completed, a current of electricity passes through the water, and the gases are thereby evolved.

4th. Thermo-Electricity.—Water is very easily decomposed by a thermo-electric pile, the electrolysing action of which is maintained by keeping the ends of the bars of which the pile is composed, the one at a high and the other at a low temperature.

The different forms of electricity known under the above names, may be used either separately or simultaneously for the decomposition of the water in the gas generator.

When this evolution of the gases takes place in a close vessel, or gas generator, a gradually augmenting compression necessarily results, which does not affect the evolution of the gases in the slightest degree. An exceedingly high pressure may thus be obtained in the gas generator or close vessel. Dr. Daniel raised it to the enormous tension of 56 atmospheres, or 840 lbs. on the square inch.

In the "Philosophical Transactions of the Royal Society, 1839," vol. 129, p. 93, 94, Professor Daniel thus describes an experiment:—"The evolution of gas, which was measured at short intervals, took place with perfect regularity, and did not appear to be in the slightest degree affected by the gradually increasing compression. In four and a half minutes, when 19 cubic inches had been collected, the compression tube burst with a loud explosion, and the fragments, which were very small, were scattered all over the laboratory. If we were to calculate that 19 cubic inches were compressed into three-tenths of an inch space unoccupied by the liquid, this would be a compression of 63 into 1, and the pressure would amount to nearly 940 lbs. on the square inch; but if we reckon, as was probably the case, that two cubic inches of the gases were kept down by the solvent power of the liquid at this high pressure, then the compression would have amounted to 56 into 1, and the pressure to 840 lbs. on the square inch."

### Electric Gas Gun.

The gases evolved at a high pressure from the decomposition of water by electricity, constitute a projectile force of very great intensity. By using them in the same way that air is employed in an air-gun, the greatest conceivable force may be impressed upon a projectile, a force, apparently, only limited by the strength of the materials of which the gas-generator is composed. Gunpowder is itself only a highly inflammable mixture, which, on being ignited, is rapidly converted into gases at a high pressure, and the gases in the electric-gas-gun would act upon the projectile in precisely the same way as the gas resulting from the ignition of gunpowder acts upon a similar projectile in an ordinary cannon; thus the force of gunpowder and that of these gases are analogous.

As to the form of an electric gas gun, it is similar to a breech-loading gun or cannon. Attached to the breech is a reservoir, or gas generator, in which water is converted into the gases at such high pressure as the officer in command may deem requisite. There is a communication between the gas-generator and the barrel or chase of the weapon, which can be opened or closed at pleasure, but which, if not closed before, will close of its own accord when the full charge of the weapon has passed into the barrel. This is accomplished either by a slightly conical piston or spigot, acting in a small hole through the barrel of the weapon, so placed that when a shot has passed over the point where it is situated, the gases press upon this piston or spigot (which is kept down by a spring), and raising it by their pressure, it acts by suitable mechanical contrivance upon the apparatus for closing the communication; or by making the shot, when it passes over a certain point in the bore, complete and break an electric circuit, which acts by suitable machinery upon the apparatus for closing the communication.

An apparatus for closing this communication is so constructed, that when it is completely closed, and not by any possibility till then, several electric sparks are passed through the gases in the barrel, which result in their explosion, and the discharge of the weapon, for I should have mentioned that these gases are endowed with a second element of force—they may be combined by an electric or other spark; or the gases may be exploded as gunpowder by the percussion of ordinary detonating powder. In combining they expand to fifteen times their volume. When the shot has, by passing from the breech to the muzzle, attained the uniformly accelerated velocity due to the high pressure of the gases, and is on the point of leaving the weapon, if the gases be then exploded the explosion will impress a force upon the shot equal to fifteen times the pressure of the gases. The small portion of pure water, which is formed by the combination of the gases, is condensed like dew on every part of the bore, and serves to lubricate the weapon, or, according to the temperature of the barrel, remains in the form of vapour, and is driven out by the succeeding discharge—the barrel never needs cleaning.

At the breech there is an aperture through which the shot is introduced into the barrel with great rapidity after each discharge, by means of a very simple piece of mechanism. The aperture has its edges bevelled outwards to insure the fitting of the piece that fills it up when the shot is introduced; there are several of these pieces accurately fitting this aperture, connected with each other by suitable links, and forming an endless chain. When the weapon is in the act of being discharged, there is a strong band, nearly half the circumference of the outside of the barrel, which is so fastened by adequate mechanical contrivances, that on the recoil of a gun after the discharge, the band is loosened by the action of the recoil, and the piece occupying the aperture falls out, and another piece bearing a shot, is brought by the action of the recoil of the weapon up an incline, under the aperture, which piece, by the return action of the weapon down the incline, is, with the shot upon it, forced into the barrel, and the band again fastened by the same return action. The shot is delivered from a hopper or reservoir of shot, (or may be placed by the hand) upon one of the pieces, by means of and during the upward action of the recoil. Instead of the band or in conjunction with it, a strong bar may be used, attached by a sort of hinge to the weapon, near the muzzle, and so arranged that when the weapon is being discharged, the end of the bar presses, with the whole weight of the weapon, against the piece occupying the aperture so as to resist the force of the gases, and when the weapon recoils, the pressure of the bar against the piece ceases and suffers it to fall out, and the next shot is introduced in the manner before described, whereupon the bar is made, by suitable mechanical contrivances, to resume its pressure against the piece by the return action of the recoil.

It is intended that the weapon shall be loaded, aimed, discharged, and entirely worked by machinery, and that the weapon and its whole working shall be capable of being fought, and in every way controlled by a single man.

The force thus developed would seem to be the best possible force to which a projectile could be subjected —a uniformly accelerated force while moving along a rifled barrel, and then (when it has received from the rifled bore a motion round its own axis) an almost instantaneous accession of immense force. It is quite obvious that these conditions are much more favourable for allowing the length of the bore or barrel of the weapon to be increased, and thereby securing greater precision of aim, and are also more favourable for the preservation of the weapon, than when the projectile is, as in the case of gunpowder, subjected to a constantly increasing and then to a constantly diminishing force. It is not, perhaps, too much to say, that a rifled electric gas gun would wear as long as a couple of rifled cannons in which gunpowder was used.

Sir H. Douglas says (p. 47):—"The main principle which should govern our choice of naval guns is, to prefer those which, with equal calibre, possess the greatest point blank range; and the practical maxim for using them should be to close to, or within that range, and depend upon precision and rapidity of fire. This is the most simple and the most efficacious use of artillery."

An electric gas gun, if wrought by machinery, would have the greatest possible precision, and its rapidity of fire might rival that of a revolver; and it is perfectly obvious that it might be lengthened to any extent, so as to secure the greatest attainable point blank range.

"It is known, both from theory and practice," says Sir Howard Douglas (p. 96), "that with equal charges and guns of equal weight, but of different lengths, the velocity of the shot increases with the length of the bore." Now these gases are much more capable of being used in weapons with great length of bore than gunpowder, because the shot is driven from the breech to the muzzle, not, as in gunpowder, by a constantly increasing, and then a constantly diminishing force, but by a uniform, or nearly uniform force, which is perfectly under command, and then is subjected to an explosive force; these are the very properties in a projectile force most favourable to precision, and the greatest point blank range. From practice at Deal, in 1839, with 32 pounder guns, one 9 ft 6 in., and the other 6 ft. 6 in. long, with charges of 6 lbs., and windage of ·175, the elevation being one degree, the range of the longer gun was 853 yards, while that of the shorter one was only 734 yards.

These experiments show the very important effects resulting from a lengthened bore, but, owing to the nature of gunpowder, the limit to the length that can be used in practice is soon reached; but the case, as respects the gases, is wholly different; there is nothing whatever to prevent that length being adopted, in the electro-gas gun, which will secure the maximum result.

These gases have another great and pre-eminent advantage over gunpowder, viz., that the force impressed upon the projectile may be varied according to the work intended to be done by it. If a *ricochet* is required, only a small quantity of the gas may be admitted into the barrel of the weapon; no time need be wasted in altering the charge, the officer in command may increase or diminish the intensity of every succeeding shot without the slightest difficulty or delay. This would be in the highest degree useful, as well as economical, in finding and altering ranges—useful when a tentative process was desirable; economical, because the angle of elevation which gave the maximum result for the minimum expenditure of gas might be given to the weapon, and the charge varied with the required range.

From the experiments of Robins and others, it appears that when gunpowder is ignited, one-half of it is converted into gases (the principal of which are carbonic acid and azote) and the remaining half assumes the form of solid matter. If the powder be loose, the volumes of the gases are from 236 to 260 times that of the powder; in rammed powder from 480 to 520 times the volume of the powder. As to the expansion of the gases due to the elevated temperature at which they are generated by the ignition of the powder, the estimates are widely dissimilar. Robins sets down the absolute explosive force of gunpowder equal to 1,000 atmospheres, that is, a pressure of 14,722 lbs. on the square inch; Hutton put it at 2,200 atmospheres, or 32,388 lbs. on the square inch. It is obvious that a considerable portion of the heat is absorbed by the gun.

With respect to the air-gun, the "Encyclopædia Metropolitana" remarks, adopting the estimate of Robins, "if the air-gun be condensed ten times, the velocity will be equal to one-tenth of that arising from gunpowder; if condensed twenty times, the velocity would be one-seventh that of gunpowder, and so on. Air-guns, however, project their balls with a much greater velocity than that assigned above, and for this reason, that as the reservoir of condensed air is commonly very large in proportion to the tube which contains the ball, its density is very little altered by passing through that tube, and consequently the ball is urged all the way by nearly the same force as at the first instant; whereas the volume of the gas arising from inflamed gunpowder is very small in proportion to the barrel of the gun, and by dilating into a comparatively large space as it urges the ball along the barrel or tube, is proportionately weakened, and it always acts less and less upon the ball in the tube. Hence it happens that air compressed only ten times into a large receiver will project its ball with a velocity little inferior to gunpowder."

What is here said of air applies with equal force to the gases. Besides, the ignition of the charge of gunpowder is not instantaneous; it is a progressive operation, so that the ball when projected by gunpowder is subject, when passing from the breech to the muzzle, first to a constantly increasing, and then to a constantly diminishing force.

It will be interesting to contrast the cost of gunpowder and of the gases. The length of a 68-pounder is 9·49 feet; the effective length is less by the semi-diameter of the bore, which is 8·12 inches—the length is, therefore, 9·11 feet, and the capacity 4·41 cubic feet. As a ton of zinc evolves 1966 cubic feet of the gases under a pressure of ten atmospheres, and as its price varies from £20 to £30, the cost per round of shot, out of a 68-pounder, would be as follows, under the following pressures. At—

| | | | | | | |
|---|---|---|---|---|---|---|
| 10 | atmospheres | 0s. 9d. | at £20 | — | 1s. 4d. | at £30. |
| 20 | „ | 1 9 | „ | — | 2 8 | „ |
| 40 | „ | 3 7 | „ | — | 5 4 | „ |
| 60 | „ | 5 4 | „ | — | 8 0 | „ |
| 80 | „ | 7 2 | „ | — | 10 9 | „ |
| 100 | „ | 8 2 | „ | — | 13 5 | „ |

Now, if the "Encyclopædia Metropolitana" be correct in saying that air, compressed ten times, will project a ball with a velocity little inferior to gunpowder, surely these gases, when compressed ten times, that is, to a pressure of ten atmospheres, and exploded, ought to rival or surpass gunpowder, as they would, in addition to the force due to the ten atmospheres, impress a force on the projectile, at the moment of its flight, fifteen times that pressure. But when contrasting the cost of the gases as a projectile force, and that of gunpowder, it is safer to be under, rather than over the mark, so then, notwithstanding the *dictum* of the "Encyclopædia Metropolitana," we will base our calculation on the assumption that the gases condensed 20 times, and developing on their explosion a force equal to 300 atmospheres, will produce effects equal to those of gunpowder; the cost for shot will, as we have just seen, be from 1s. 9d. to 2s. 8d.*

The cost of gunpowder varies, of course, with the price of the articles from which it is manufactured; it ranges from one to two shillings per lb. A 68-pounder takes 16 pounds for a charge; the cost per shot is therefore from 16s. to 32s., consequently the gases are by far the cheaper force, for even at 100 atmospheres they would only cost from 8s. 2d. to 13s. 5d., scarcely one-half the price of gunpowder, but at 20 atmospheres they would scarcely be one-tenth of the price.

Gunpowder is deteriorated or destroyed by the absorption of moisture; this could not happen to the gases. This absorption of damp is a constant cause of "great and unknown losses of strength;" and a little more or less moisture will alter most materially the accuracy of practice. Attempts to protect gunpowder from moisture are a constant source of heavy outlay, which should be borne in mind when comparing the relative cheapness of the forces, and "no degree of care" can altogether preserve it from receiving some injury. (Sir H. Douglas.)

Then the force impressed upon the projectile might be increased *ad libitum*. This cannot be done with gunpowder, for if the charge be increased beyond a certain point, a diminution of force results, as part of the powder is shot away unignited, and the powder ignited acts for a shorter space on the ball, but in the electric-gas gun the pressure may be raised to any point in the gas generator so as to impress the required force upon the projectile; thus, if it was found that a 100-pounder, propelled by a force equal to that of gunpowder, had no effect upon an iron-plated vessel, the force might be doubled or trebled until the desired result was achieved; indeed, it is probable that these weapons would settle the question of armour-plates, because if, as Mr. Scott Russell holds, the thickness of the plates cannot be usefully increased beyond 4½ inches, as soon as a weapon is constructed of sufficient force to destroy this armour, it will cease to be a protection, and will only insure the sinking or capsizing of the unlucky vessel it was intended to protect, like the knights of former days, whose armour at last became so heavy that, if they chanced to be unhorsed, they were compelled to lie prone, unable either to renew the fight, or to consult their safety by a retreat.

It may be observed that it would be difficult, when the firing proceeded from works in any way extensive, or from masked batteries, for an enemy to discover the precise point where one of these weapons which threw the projectiles was situated, as there would be no smoke and no report (for a vacuum would be formed by the explosion of the gases). In most cases this would prove of signal advantage, among others—as not affording a mark for the shot of the enemy, should he seek to disable the weapon. Besides, the absence of smoke would not interfere with the aim of other weapons, and the absence of noise would enable the orders given by those in command to be distinctly heard.

There would be practically no report; the report, such as it would be, could not be heard beyond a few yards—it would be 500 times less than that of a cannon, and 10 times less than that of an air-gun.

When a cannon becomes heated by repeated discharges of gunpowder, the elasticity of the metal of which it is composed is diminished, and the properties of the weapon are impaired. It is probable that rifled cannon (other things being equal) are liable to be more quickly heated than those with a smooth bore, owing to the fact that the ball meets with greater resistance in moving along a rifled bore than a smooth bore, and consequently consumes more time in reaching the muzzle. The barrel of the weapon is therefore subjected for a longer period to the action of the highly heated gases evolved by the ignition of the gunpowder. This result could not arise from the action of the gases in the electric-gas gun, for the heat evolved by the detonation of the gas is by no means great. The electric-gas gun is therefore, so far as this point is concerned, the more perfect weapon, being capable of more incessant and prolonged work.

The electric-gas gun is eminently suited for being wrought by machinery, thereby securing greater precision of aim, greater rapidity in firing, and enabling one man to accomplish the work of many. The recoil of the gun might also, if necessary, be turned to account in increasing the condensation of the gases, and for the purpose, when requisite, of forcing water into the gas generator when the weapon is in action, to replace that consumed by discharging the weapon. This may be accomplished by a plunger, similar to that of a Bramah press, moving in the plane of the recoil.

An electric-gas-gun, if wrought by machinery, might be made to cover an object as accurately and with as much precision as a theodolite, the rapidity of its discharge might be made to rival or surpass that of a revolver, only it would be continuous and not limited, as in a revolver, to half a dozen rounds, and it would be as much under the control of one man as the most gigantic of our steam-engines. The machinery for the weapon might be wrought by a donkey engine, the cylinders of which could be supplied from the gas generator, in the manner mentioned below. In a fortress or ship defended by a few such weapons, one man might do the work of fifty.

In the interests of peace, it is no small recommendation in favour of these weapons that they are more calculated for defence than for offence.

The steam gun, as is well known, throws its projectiles with great rapidity. Now if the gases of which I have been speaking were substituted for steam they would be much more efficient; firstly, because a higher pressure could be obtained with much less danger; and, secondly, at the moment the projectile was leaving the tube or barrel the gases might be exploded, thus impressing upon the ball or projectile an augmented force fifteen times greater than that to which it is subjected in the American steam gun; consequently the ball or projectile would be at least fifteen or sixteen times more effective under the action of the gases in an electric gas gun, than it is under the action of the steam in the steam gun.

A cubic foot of water produces at the mean pressure about 1,980 cubic feet of the mixed gases—that is, about 1,320 cubic feet of hydrogen gas, and 660 cubic feet of oxygen gas, or nine pounds of water produce eight pounds of oxygen gas and one of hydrogen. A cubic foot of water produces 1,700 cubic feet of steam at the mean pressure 212° Fahr. The relative volume of the gases, at that pressure and temperature, would be 2,572 cubic feet, so that the advantages are on the side of the gases in this point very decidedly.

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* See Appendix I., page 414.

In a fortress defended by these weapons there would be no need to tremble for the safety of the gunpowder magazine, and the apparatus for supplying the electricity might be placed out of reach of harm. And now as to cost, after the first cost of the requisite apparatus has been defrayed, the cost of maintaining the electrolyzing action in the gas generator will mainly depend, if voltaic electricity be used, on the value of the materials consumed in the battery as compared with the value of the products of the battery. If common electricity be employed, its cost will be measured by the amount of mechanical effort necessary for its development. If magneto-electricity be used its cost will depend upon the mechanical force requisite to keep the magneto-electric machines in action. If thermo-electricity be employed its cost will depend on by the expense incurred in keeping the extremities of the bars of the thermo-electric piles at different temperatures.

The advantages of these electric-gas guns, as compared with gunpowder guns, are:—

1. The projectile force employed is very much cheaper than gunpowder.
2. Its practice is more certain and uniform, not being liable to be affected by damp, &c.
3. It is more under control; the force with which a projectile is driven may be diminished or augmented at pleasure.
4. It is capable of being wrought by machinery (driven by the gases from its own gas generator), thereby ensuring greater precision of aim, greater rapidity of firing, and enabling one man to do the work of many.
5. It is less dangerous, both to the men who work it, and to the ship or fortress which it defends, as it needs no powder magazine, which might be blown up by shot, shell, or lightning.
6. A force is applied to the projectile more favourably, resulting in less strain upon the weapon, and its greater durability; besides, not being liable to be heated, it is the more perfect weapon, being capable of more incessant and prolonged work.
7. The discharge being accompanied with neither smoke, flame, nor report, it could not afford a marked object for the enemy's shot.
8. Its superior powers of horizontal or point blank firing at low elevations, "the best test of the real power and value of a gun," "its real service value."

### THE ELECTRIC-GAS SHELL.

These gases, evolved by the decomposition of water by electricity, may be forced, at a very high pressure, into metal shells, similar to shells used for offensive operations in war, the shells being so constructed that on striking any body, an electric spark, or detonating spark, could be elicited, which would result in the detonation of the gas and the bursting of the shell.

Then these gases might be used with other bodies in the shell, gaseous, liquid, or solid, that would contribute to augment the violence of bursting.

## A NEW MOTIVE FORCE.

When gases are maintained at a high pressure or tension in a vessel, corresponding to the boiler of a steam engine, they will, if admitted into a cylinder, press upon the piston, and perform all the functions discharged by steam in working an engine.

### ELECTRIC GAS ENGINE.

Gases generated under a high pressure, by the decomposition of water by electricity, will act fully as effectively as steam when admitted into the cylinder of a steam engine. The pressure may be raised to a point at which it would be perilous to work steam, owing to the facility with which the strength of the reservoir may be increased. Then, no additional cost is incurred by working at the highest pressure; precisely the same electro-motive force is expended in effecting decomposition at all pressures. Thus the strength of the gas-generator is the only practical limit to this enormous force, the real obstacle to its most economical application, an obstacle which doubtless will gradually yield to the ingenuity of engine manufacturers.

These gases may be wrought expansively, which will result in very great augmentation of the work done by the engine, for the same expenditure of electro-motive force.

After the gases, by passing through the cylinder, have impressed upon the piston the force due to the pressure under which they are generated, they may be utilised in either of the following ways:—

I. By detonating the gases after they have expanded; while in the cylinder, they may be combined by an electric spark. In combining they expand to fifteen times their bulk, and consequently impress a force on the piston equal to fifteen times the pressure which the gases exerted. A heavy fly-wheel would prevent the loss of *vis viva* which might attend the suddenness of the application of this force.

When the gases are combined by an electric spark, they are converted into water, and a vacuum results similar to that occasioned in a condensing steam engine by the condensation of the steam. By the vacuum which is thus formed by the combination of the gases, the advantages of the high-pressure and condensing steam engines may be combined in the electric-gas engine.

The sources of force are, therefore, threefold.

1st. The high pressure in the gas generator, which may be taken at 50 atmospheres, or 736 lbs. to the square inch, although in high pressure steam engines it rarely exceeds 120 lbs. There can be little doubt but that the reservoir might be readily constructed sufficiently strong to work safely at a pressure of 60 or even 100 atmospheres, particularly when all the inducements which economy can hold out are on the side of high pressure in the electric-gas engines.

2nd.—The expansion of the gases to 15 times their volume exerts a force on the piston.

3rd.—A vacuum which will give a useful effect of from 13 to 14 pounds per square inch.

II. The combustion of the gases after passing through the cylinder, may be employed for heating the gases in the cylinder while expanding, and thereby increasing their elastic force; it is obvious that this heating process must be applied while the gases are in the cylinder, for no advantage would accrue from increasing their tension in the gas generator, as they can be evolved at the highest possible pressure there without additional expense, but if they be heated while expanding, it is obvious that the work done by them would be much increased.

III. By burning the gases after passing the cylinder, for the development of thermo-electricity, to be employed in aid of the electricity used in decomposing water in the gas generator.

IV. By using the gases after passing through the cylinder for the purpose of developing electro-motive force, to go in aid of that employed in decomposing the water in the gas generator; theoretically the electro-motive force developed by the combination of the gases ought to decompose an amount of water equal to their own weight. This is, I believe, the theoretic effect of Groves gas battery.

Thus, then, the gases, after being used in the cylinder, may be employed in one of three ways:—1. For the production of an electro-motive force by thermo-electricity or by voltaic-electricity. 2. For the production of a detonating force, and the resulting vacuum. 3. For increasing by their combustion the tension of the gases in the cylinder.

It may be observed, that in an electric gas engine the gases may be wrought expansively, which will not only result in considerable saving, but will also materially diminish the possible practical inconvenience of the detonation of the gases in the cylinder; if, for example, the gases were wrought at 50 atmospheres, and were allowed, before being detonated, to expand in the cylinder till the pressure was one quarter of an atmosphere, the pressure on the piston when detonated, would be less than one-twelfth of the initial pressure of the gases in the cylinder; what the proper amount of expansion to be allowed is, would very soon be practically determined, when the electric gas engines come into operation.†

The strength of the reservoir, or gas generator, in an electric-gas engine, corresponding with the boiler in a steam engine, might be increased to almost any amount required; the difficulties which prevent the strength of a steam boiler from being increased beyond a certain point could not operate as regards a gas generator. One of the main objects kept constantly in view in the construction of a steam boiler, is the securing the largest possible amount of heating surface; now the strength of a boiler is the strength of the weakest part of it, consequently, as its surface is extended, the chances of a flaw or weakness in some part of that surface are increased; then if the thickness of the plates were unduly increased it would interfere with the action of the fire. The riveting of the plates is estimated to reduce the strength one-third. The highest tension attained in high-pressure steam engines scarcely, if ever, exceeds eight atmospheres, or 120 lbs., per square inch; in an electric-gas engine, the highest pressure may be maintained in the gas generator at precisely the same cost as the lowest; consequently, the higher the pressure the less the expense for equal amounts of work done. With regard to the construction of the reservoir, or gas generator, the form of greatest strength may be adopted, and the thickness of its parts augmented to any conceivable amount.

If necessary, to obviate any danger that might possibly arise from the accidental detonation of the gases in the gas generator (if such a thing be possible), the gas generator may be divided into two compartments, in which each gas may be kept separate, thus rendering such a detonation wholly impossible. With regard to the cylinder, it may, if found requisite, be divided, during the first part of the stroke, into two separate compartments, proportioned in capacity to the respective volumes of the two gases, but so as that during the latter part of the stroke, the gases may become mixed, so as to be, if necessary, detonated by an electric or other spark.

The time must come, if it has not already arrived, when electricity will be produced more cheaply than steam. Every mechanical and chemical change which takes place in bodies, results in setting free some electricity; thus, if two bodies are in contact and they are suddenly removed, there is an electrical disturbance. When water boils electricity passes off in the steam. The fire in the grate and the flame of the gas-lamps are evolving electricity.

Every chemical change in the constitution of bodies results in the development of electricity. A galvanic battery merely collects and applies the electricity evolved by the chemical changes going on in its cells. If some method could be discovered of making the products of the chemical action in the battery as valuable, or nearly as valuable, as the zinc or other agents of which the battery is composed, the great problem would be solved, and electricity might take its place side by side with steam as a practical motive force.

In conclusion, I may observe that the proposed electric-gas engine and electric-gas gun are original ideas. It first struck me that electricity might be used as a motive force about 1849, when attending the lectures of a most able and amiable gentleman, whose admirable Treatise on Heat ranks him high amongst modern philosophers.

I may also perhaps mention that I gave notice, before the meeting of the British Association in last September, of my intention of reading a paper on this subject, but was prevented, by unavoidable circumstances, from going to Manchester.

44, Chancery-lane, London.

## APPENDIX I.

It should be remarked, that in the electric gas-gun and steam-gun the projectile, in its passage from the breech to the muzzle, is subjected to a constant force, and of course attains the uniformly accelerated velocity due to that force minus the sum of the resistances resulting from its passage along the barrel; then, as to the detonation, though popularly speaking it takes no time, it is really not so—no operation in nature is so—the lightning's flash consumes time; from hence it appears that $v^2 = 2fs$ is the correct formula.

In an ordinary cannon, until the whole of the charge of gunpowder is ignited, the force impressed on the ball is a constantly increasing force, and then it becomes a constantly diminishing force; this force varies as the space of the barrel traversed by the ball. The velocity of the ball when all the gunpowder has been ignited is equal to the square root of the force into the space, *i.e.*, $v = \sqrt{fs}$, but when the ball is urged by the gases, as the force is uniform, $v' = \sqrt{2f's}$, consequently the velocities are to each other as one to the square root of two, that is $v : v^1 :: 1 : \sqrt{2}$.

If the space traversed by a shot in its passage from the breech of the muzzle of the electric-gas gun be conceived to be divided into 100 parts, and the time of transit be also divided into a like number of equal parts, the space passed through under the action of the uniform force of the gases during the first division of time, will be to the space passed through during the last divison of time, as 1 to 199; now, considering this immense acceleration, it is, perhaps, under the mark to assume that the force developed by the detonation of the gases would act upon the ball through the last ten of these spaces. The gases then act upon the ball through 90 spaces, and the explosion through 10 spaces.

If $v$ be the velocity of a projectile urged by gunpowder, and $v'$ the velocity of one projected by the gases, and $f$ and $f'$ be those forces respectively, and $\lambda$ be the effective length of the weapon, $\lambda'$ the length of the charge, and $\lambda''$ the space through which the detonation of the gases act upon the projectile, and $x$ the co-efficient of expansion for the gases on explosion, then we have for gunpowder—

$$v = \sqrt{f(\lambda - \lambda')}, \text{ and for the gases—}$$

$$v' = \sqrt{2f'(\lambda - \lambda'') + 2xf\lambda''}$$

$$= \sqrt{2f'(\lambda + (x - 1)\lambda'')}$$

but when gunpowder is used, $\lambda'$ is one-third of $\lambda$, therefore $v = f, \sqrt{66\cdot6}$ and $f = \frac{v^2}{66\cdot6}$; but in the case of the gases $\lambda''$ is ten, and $v' = \sqrt{2f(100 + 140)} = \sqrt{480f'}$ and $f' = \frac{v'^2}{480}$. We have, therefore, the proportion $f : f' :: \frac{v^2}{66\cdot6} : \frac{v'^2}{480}$, but if $v$ and $v'$ be equal, we have $f' = 7\cdot2f$, that is, if the gases in the gas generator be maintained at a pressure rather less than one-seventh that of the real pressure of the gases resulting from the explosion of gunpowder, they would produce an effect eqnal to that produced by gunpower.

Sir H. Douglas says the charge producing the maximum velocity is about one-third of the length of the bore (p. 44). I assume the "charge" means the charge of gunpowder and shot, consequently, of the 100 parts, the gunpowder occupies 25·15. Hutton estimates that gunpowder expands 2,200 times its volume: the pressure on the shot when it reached the muzzle would consequently be a little more than one-fourth of that, or 550 atmospheres. But there are three deductions which must be made from this: first, the volume of the powder is less by the volume of the bag containing it, which, in a 68-pounder, would be about ·02 foot—then there is the windage, for which Hutton deducted a third of the useful effect, but as these weapons are to be breech-loaders, we need not allow for windage—thirdly, part of the charge escapes through the vent. These three deductions would leave the force of the gases resulting from the ignition of the gunpowder at, say a third less, or ·366 atmospheres, but it is seen above that $f = 7{\cdot}2\, f'$, therefore $f' = \frac{366}{7{\cdot}2} = 50{\cdot}83$ atmospheres, which in round numbers gives a tension of 51 atmospheres, as that capable of imparting as high a velocity to a projectile as gunpowder. But as stated in the text, the precision and power of these weapons would be augmented by increasing the length of the bore. Let us suppose the bore of a 68-pounder lengthened by $\frac{6}{10}$'s then $\lambda - \lambda'' = 150$. $\lambda = 160$. We have then—

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† See Appendix II., page 415.

$$v' = \sqrt{2\, f' \,(160 + 140)} = \sqrt{600\, f'} \text{ and}$$

$$f : f' :: \frac{v^2}{66{\cdot}6} : \frac{v'^2}{600} \text{ therefore } f' = 9\, f$$

$$\text{consequently, then } f' = \frac{366}{9} = 40{\cdot}73$$

atmospheres, the gases at a pressure of 41 atmospheres can, in a 68 pounder, the effective length of whose bore is 13·63 feet, project a shot with the velocity with which a shot would leave an ordinary 68 pounder propelled by a charge of 16 pounds of gunpowder.

If the length of the bore of a 68-pounder were doubled, that is, if it were increased to nearly 19 feet, the gases in the gas generator would only require to be kept at a pressure of 25½ atmospheres to project a shot with a velocity equal to gunpowder.

It may be remarked that nothing can be more widely different than the estimates that have been formed by the ablest writers on the precise measure of the explosive force of gunpowder. Sir H. Douglas says, "Much uncertainty exists respecting the expansive force of fired gunpowder," so that, notwithstanding what is contained in this note, the estimate based on the "Encyclopædia Metropolitana" in the text may be the right one.

## APPENDIX II.

It may be interesting to attempt to indicate the work which the gases can perform when employed in an electric-gas engine, by taking the general formula as given by De Pambour for the steam-engine, which determines the load, the velocity, and the evaporation, substituting, of course, for Dulong and Petit's law for the expansion of steam, that of Boyle or Marriotte for the elastic force of gases.

Denoting by $v$ the velocity of the piston in feet per second; $a$, the area of the piston in square feet; $r$, the load of the engine in pounds; $s$, the effective number of cubic feet of water decomposed in the reservoir per minute; $l$, the stroke of the piston in feet; $l'$, the portion traversed when the expansion begins; $c$, the clearance of the cylinder; $f$, the friction of the engine when unloaded; $\delta$, the increase of friction accruing per unit of the load $r$; $p$, the pressure against the opposite side of the piston; P, the pressure in the gas-generator; P′, the pressure in the cylinder before the expansion; R, the total resistance; $s$, the volume of water decomposed in the gas-generator per unit of time; $\mu$, the relative volume of the gases in relation to the water which produced them; we have for the gases the following formulæ:—

1.

$$v = \frac{l}{l'+c}\;\frac{s}{a}\;\frac{1}{(1+\delta)\; p + p + f}$$

2.

$$ar = \frac{l}{l'+c}\;\frac{s}{(1+\delta)\; v}\;\frac{1}{1+\delta}\;[p+f]$$

III.

$$s = \frac{l'+c}{l}\; a\, v\, [(1+\delta)\, r + p + f]$$

$$\text{Useful effect} = a\, r\, v$$

After detonation, or sudden expansion of the volume of the gas, when detonated by an electric spark, as before mentioned, the resulting velocity will be in proportion to the square root of the impressing force or pressure.

There will necessarily be an equality between the production of gas and its expenditure. If P′ be the pressure of the gas in the cylinder, then $\frac{\mu s}{P'}$ is the volume of gas transmitted per unit of time to the cylinder. $a\,(l'+c)$ is the gas expended at each stroke, and if there be K strokes in a unit of time, the expense for that unit will be K $a\,(l' + e)$—but the velocity per unit of time is, $v = \mathrm{K}\, l$ $\therefore$ $\mathrm{K} = \frac{v}{l}$, and $\frac{v\, a\, (l' + c)}{l}$ is the gas expended per unit of time—therefore $\frac{\mu s}{P} = \frac{v\, a\, (l' + c)}{l}$ and $P' = \frac{\mu s}{v a}\cdot\frac{l}{l + c}$

But, when detonated, the gas expands to $x$ times its former volume, the force exerted on the piston is $x\, P'$, denoting by $x$ the co-efficient of expansion, and by $P'$ the pressure of the gas on the piston at the point $l'$,

the resulting velocity is $v_{\prime\prime} = x^{\frac12}\, P^{\frac12} = \left(\frac{x \mu s}{v\, a}\cdot\frac{l}{l' + c}\right)^{\frac12}$

or, $v_{\prime\prime}^2 = \frac{x\, \mu\, s}{v\, a}\,\frac{l}{l' + c}$. From this equation we can determine the velocity developed by the detonation of the gases at each stroke, for each unit of time it will be K times that amount.

## Home Correspondence.

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### THE EFFECT OF PRIZES ON MANUFACTURES.

SIR,—Not having been able to attend the reading of Mr. Sidney's paper on the 23rd April, you will perhaps allow me to offer a few remarks on the very interesting topic which formed the subject of it. I must first express my surprise at seeing the question of prizes so tardily brought forward in its present shape, the point having been already long settled that there were to be prizes awarded in the forthcoming Exhibition. I cannot help regretting that Mr. Sidney, instead of condemning the system altogether, did not turn his undeniable talent to the more useful task of finding and pointing out how the defects of that system were to be remedied. His own ideas on the subject, and the remarks they would have elicited from his hearers, might then have resulted in some practical hints to the jurors who are about to commence their labours.

The main question proposed having been fully and ably discussed the other night, I shall not enter into it again, but shall merely remark that Mr. Sidney would, I think, find but few exhibitors to join him in the assertion, "that eminent English manufacturers look on the offer of prizes with contempt." The principal argument, however, and the most forcible one he makes use of against prizes, is that they were not awarded with discrimination in some instances by the jurors of 1851. Admitting this to be a fact, it arose, I believe, in a great measure, from the two following causes, viz.:—The excess of the scientific over the practical element in the formation of the juries, and the heterogeneous character of the articles often thrown into the same class. To quote an example, Class xxix. embraced nearly twenty species of manufactures, all perfectly distinct from each other, and among the twelve jurors and associates there were but two practical men; the others were very eminent men of science, but could only have a very superficial knowledge of the various wares they had to examine. In the present Exhibition, although a little, perhaps unavoidable, confusion still exists in the classification of some of the goods, the juries are likely to contain a greater proportion of practical men, having been, through a very wise regulation, elected by the exhibitors themselves, who ought to know the most able judges of their merits. As to the objection raised to jurors being at the same time exhibitors, I do not see how this can influence their decision in any way, for the self-denial they show in renouncing all prizes, is a sufficient guarantee of the impartiality they intend to display towards their fellow exhibitors. I therefore hope that the result of the forthcoming awards will be, not to "make things pleasant" for all parties concerned, which is both undesirable and impossible, but to reward the truly deserving and stimulate improvements in manufactures, which is, or ought to be, the sole aim of Exhibition Prizes.—I remain, &c., E. RIMMEL, Juror, Class 4.

96, Strand, 26th April, 1862.

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SIR,—Not having had it in my power to attend the reading of the paper by Mr. Sidney on Wednesday evening, the 23rd of April, and the very interesting discussion which followed, I beg to offer my ideas on the law of patent right, embodied in the following letter, addressed in reply to the Secretary of the Patent Law Association, inviting me to join that proposed Institution.

I am, &c., HENRY W. REVELEY.

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Parkstone, Poole, Dorset, April 22nd, 1862.

SIR,—In reply to your favour of the 17th inst., I beg to state that I am sorry I cannot unite with your proposed association for the support of the present system of patent right, which seems to have been created for the special benefit of the gentlemen of the law connected therewith and the manufacturing tradesmen as an advertisement.

That the law of patent right is a species of monopoly, adverse to the interests of the consumers of patented articles and processes, by unnaturally increasing the cost thereof, is a very minor consideration.

The system of patent rights is a kind of lottery most injurious to the patentees themselves, because ninety-nine out of a hundred never derive the slightest benefit, and not one in a thousand ever realises anything like a fortune from his appeal to the patent laws.

It is impossible to prevent piracy or evasion, and the lawsuits arising thereon entail heavy expenses, from which the patentee can derive nothing but loss; and it often happens that a patent becomes useless with the addition of a rider from some other patentee, whose license must be paid for.

In the history of the patent laws two remarkable cases may be pointed out; for instance, Hobday's patent snuffers, from their extreme simplicity, were never pirated or superseded, the common fate of most patents, but it will be difficult to find a parallel case. Another is the patent taken out by Messrs Boulton and Watt for their double-acting steam-engine. In order to sustain their rights, that firm had to take out innumerable secondary patents, and stand many very heavy lawsuits in consequence of endless piracies, evasions, and infringements, at such an enormous cost that their term was ultimately extended to the period of twenty-one years. The public was in the mean time charged enormously for their engines, while the firm made but little profit, scarcely more than if they had carried on without any patent at all, until after their term had expired. The public at large would have been gainers if it had presented the sum of £100,000 to the firm in lieu of any patent right whatever.

The patent laws crush many good and useful inventions in the bud, because if the inventor be too poor or too prudent to expend his slender means in such a lottery, he either consigns his invention to oblivion, or enlists a partner in the business, for whose debts he becomes liable to the whole extent of his property, and who in many cases absorbs the whole of the profits, if any, resulting from the venture. Under the present system no invention, however useful or profitable, can be brought out unless secured by patent right.

Nine-tenths of all existing patents might, if it were worth while, be set aside, either from previous patents taken out for the same or similar objects, or previous publication, as in the case of the so called Armstrong gun, for twisted gun-barrels, formed of spiral coils of wrought-iron, have been made time out of mind. Moreover, in this case the board of ordnance committed the error of purchasing the Armstrong patent at an enormous cost, when the board had been in possession of the identical plan in principle, which was deposited with the ordnance department unconditionally by the writer two years before the date of Sir W. Armstrong's patent. In stating that the principle is identical, that is to say the plan of forming the body of the gun by means of a spiral coil of wrought-iron or soft steel, it may be necessary to explain that the Armstrong patent does not fully carry out my intention, which is to envelope the wrought-iron, unburstable tube, with a jacket of cast-iron, of sufficient weight to resist inordinate recoil, always necessarily detracting from the ultimate range of every species of projectile. It may also be observed that the general opinion at present is that the powder should not be of a character to explode too quickly, because it would then burst the gun without propelling the ball, and on that principle the powder used in the Armstrong gun is granulated nearly as coarse as coffee grains, a process diametrically opposed to the reason assigned for the granulation of gunpowder at all, as mealed powder has no force.

The natural conclusion to be drawn from these premises is that the ultimate range of projectiles has not yet been practically obtained, and that the new white gunpowder, requiring no granulation, and consequently occupying much less space in the barrel, will, from its quicker ignition, obtain a far greater range with guns of sufficient strength and weight than the ordinary powder at present in use, which must of necessity be granulated.

The argument much used in favour of the patent laws, namely, that through their influence only are inventions produced, has no weight whatever, because good and useful inventions would be equally produced if such laws had never been in existence. In fact all the means and appliances of common life were originally true inventions, produced some thousands of years before the first patent right was granted in the dark and semi-barbarous ages, about the time of the reign of Queen Elizabeth.

Holding such sentiments on the subject of the patent laws, you will not be much surprised to find that I am not inclined at present to join your proposed Patent Association.

I am, &c., HENRY W. REVELEY.

To Robert Richardson, Esq.,
26, Great George-street, Westminster.

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## MR. WINKWOKTH'S PAPER ON SILK.

SIR,—In the paper read by Mr. Winkworth on the 30th ult., and the discussion which followed, as given in the *Journal*, there are misstatements which ought, I think, to be corrected. Mr. Winkworth says that spun silk was within the last few years worth only 6d. per lb. It never was within six times that sum. Mr. Chadwick is made to say that he produced organzine silk of from 4½ to 5 deniers, but this must surely be a mistake; organzine so fine was never seen. Mr. Hawes's statement as to what Mr. Huskisson did in 1852, is evidently a misprint for a much earlier date (1826). I am, &c.,

D. KEITH.

124, Wood-st., and 13, Goldsmith-st., Cheapside,
May 5th, 1862.

## To Correspondents.

ERRATUM.—In the last number of the *Journal*, page 397, col. 1, line 19 from bottom, for "THOMAS" read "JOHN."

## MEETINGS FOR THE ENSUING WEEK.

MON......R. Geographical, 8½. 1. Lieut.-Col. T. B. Collinson, R.E., "Description of the Ruins of Cassope, in Epirus, near Preirsa." 2. Mr. William Kelly, F.R.G.S., "British Columbia." 3. Commander R. C. Mayne, R.N., F.R.G.S., "Explorations in Vancouver Island."
R. Horticultural, 2.
TUES. ...Medical and Chirurgical, 8½.
Civil Engineers, 8. 1. Mr. H. C. Forde, "The Malta and Alexandria Cable." 2. Mr. C. W. Siemens, "On the Electrical tests employed during the construction of the Malta and Alexandria Telegraph, and on Insulating and Protecting Submarine Cables."
Zoological, 9.
Syro-Egyptian, 7½.

Wed. ...Society of Arts., 8. Mr. John Arthur Phillips, "On Gold Mining, and the Gold Discoveries made since 1851."
Graphic, 8.
Microscopical. 8.
Literary Fund, 3.
Archæological Assoc., 8½.
R. Geograpical. President's Soirée, at Bath House, Piccadily.
Thurs...Royal, 8½.
Antiquaries, 8½.
Chemical, 8.
Numismatic, 7.
Royal Society Club, 6.
Fri. ......Royal Inst., 8.
Royal United Service Inst., 3. Lieut.-Col. A. Cunningham Robertson, "Military Training, considered principally with reference to the most advantageous arrangement of the daily exercises and occupations of Private Soldiers of Infantry."

## PATENT LAW AMENDMENT ACT.

### APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

1063. J. F. Spencer, Newcastle-on-Tyne—Imp. in steam engines.
1064. H. C. Lee, 11, Lawrence Poultney-lane—Imp. in knitting machines.
1066. J. Beard, Leonard Stanley, Gloucestershire—An imp. or imps. in sofa beds or sofa bedsteads.
1067. J. M. French, Birmingham—Imp. in upright pianofortes.
1068. J. Darlington, 26, Gresham-street—Imp. in the arrangement of marine telegraph wires and cables.
1069. J. K. Hampshire, Whittington, Derby—A safety cage with disconnecting catch to prevent accidents in the working of coal and other mines arising from the over winding or breaking of the ropes or other parts used for hoisting purposes.
1071. C. Harratt, Hornsey-lane, Highgate—Imp. in the manufacture of masts, yards, and booms.
1073. R. A. Brooman, 166, Fleet-street—Imp. in reaping and mowing machines. (A com.)
1075. R. A. Brooman, 166, Fleet-street—Imp. in pumps. (A com.)
1076. R. A. Brooman, 166, Fleet-street—Improved hobby horse. (A com.)

[*From Gazette, May* 2nd, 1862.]

*Dated* 11*th February*, 1862.

360. G. Lindemann, Manchester—Imp. in applying gas for the purpose of singeing yarns or threads and woven fabrics, and for obtaining heat for other purposes.

*Dated* 20*th February*, 1862.

451. E. M. Stoehr, Manchester—Imp. in the manufacture of manganese, and in the combinations of manganese with other metals. (A com.)

*Dated* 14*th March*, 1862.

710. W. Turner, 39, Hockley, Nottingham—Imp. in the construction of bakers' ovens, and in the use of furnaces and other apparatus connected therewith, and in the means or appliances employed therein.

*Dated* 15*th March*, 1862.

714. C. N. Kottula, Belle-isle—Imp. in the manufacture of combined soaps.

*Dated* 17*th March*, 1862.

729. W. E. Gedge, 11, Wellington-street, Strand—Imp. in the manufacture of crinolines. (A com.)

*Dated* 31*st March*, 1862.

901. J. M. Clements, Birmingham—Certain imp. in sewing machines for performing the various kinds of work necessary in stitching, button and eyelet-hole working, embroidering, and sewing generally.

*Dated* 1*st April*, 1862.

911. W. Turner, 39, Hockley, Nottingham—Imp. in machinery or apparatus employed in the manufacture of dough, and especially of fermented dough.

*Dated* 3*rd April*, 1862.

938. W. Helme, Caldbeck, Cumberland—Imp. in firelighters.
939. R. Morton, Stockton-on-Tees—Imp. in refrigerators or apparatus for cooling liquids, parts of which imp. are also applicable to distillation, surface condensation, heating air for blast furnaces, and other similar purposes.

*Dated* 4*th April*, 1862.

956. T. Silver, 20, Bury-street, St. James's—Imp. in governors for regulating the speed of steam and other engines.

*Dated* 9*th April*, 1862.

1010. J. Bullough and J. Bullough, Baxenden, near Accrington—Imp. in looms for weaving.

*Dated* 10*th April*, 1862.

1021. D. Fryer, Carlton-square, Old Kent-road, and W. J. Williams, Arundel-street, Strand—Imp. in the method of and apparatus for letting on and cutting off the supply of gas to groups or districts of street and other lamps from a central point or depot.
1038. A. Trimen, 9, Adam-street, Adelphi—The protection and solidification of magnesian limestone and other stones, and for the prevention of the passage of water through the same.

*Dated* 12*th April*, 1862.

1054. J. Bunnett, Deptford, Kent—Imp. in revolving shutters, and in machinery for producing the same.

*Dated* 14*th April*, 1862.

1070. J. Dargue, 63, Cobden-street, Lister-hills, Bradford—Imp. in machinery for preparing and combing wool and other fibrous materials.

*Dated* 15*th April*, 1862.

1079. J. Taylor, Lyon Mill, Oldham—Imp. in machinery or apparatus for preparing cotton and other fibrous materials to be spun.
1080. T. H. Bennett, Winchester-house, Southwark—Imp. in the manufacture of hats, caps, or other coverings for the head.
1081. Col. F. A. Le Mat, New Orleans, U.S., and C. F. Girard, Washington, U.S.—Imp. in the construction of revolving and repeating fire-arms, part of which invention is also applicable to other arms.
1082. Lieut. R. Roche, R.N., Southsea, Hants—An imp. in gun carriages.
1083. C. R. Heap, Great George-street, Westminster—An improved construction of railway chair. (A com.)
1085. G. Bedson, Manchester—Imp. in the manufacture of wire ropes, and in the preparation of wire for such manufacture.
1086. J. Platt, Oldham, and W. Cheetham, Moscow, Russia—Imp. in looms for weaving.
1087. J. Platt and W. Richardson, Oldham—Imp. in machinery or apparatus for cleaning wool and other hairs of animals from burrs and other foreign matters.
1088. R. A. Peacock, St. Helier, Jersey—Imp. in constructing and working lock gates for docks, harbours, canals, and navigable rivers.
1089. W. Clark, 53, Chancery-lane—Imp. in ornamenting fabrics and other surfaces. (A com.)
1091. F. C. Phillipson, Munzstrasse, Berlin—Imp. in steam hammers. (A com.)
1092. J. Crossdale, 2, Rotherfield-street, Islington—Certain imp. in boots and shoes for ventilating same.
1093. R. Rains, 4, Crescent, Bridge-street, Blackfriars—Imp. in apparatus for freezing, cooling, and churning. (A com.)

*Dated* 16*th April*, 1862.

1094. S. Barrett, 8, Clifton-street, Finsbury—Imp. in projectiles.
1095. F. N. Gisborne, 3, Adelaide-place, London-bridge—Imp. in the construction of electric targets for rifle and gun practice.
1097. J. Barbour, Liverpool—Imp. applicable to upholsterers' and other hand hammers. (A com.)
1098. W. F. Lock, Haylands, near Ryde, Isle of Wight—An elongated projectile to be shot from smooth bored ordnance, and which shall retain during its flight the longer axis in the direction of its line of flight similarly to elongated projectiles propelled from rifled ordnance.
1099. J. W. Hadwen, Kebroyd Mills, Halifax—Imp. in the treatment and application of soft silk waste.
1100. D. Stott, Stainland, Yorkshire—Imp. in the manufacture of rings from paper, millboard, or pasteboard applicable for steam or other pipe joints, bobbin ends, and other purposes, and in the means or apparatus employed therein, which are also applicable to the manufacture of rings from other flexible substances.
1101. J. Mackay, Liverpool—Certain imp. in projectiles for fire arms.
1102. J. M. Rowan, Glasgow—Imp. in manufacturing articles of cast steel.
1103. R. Cochran and R. Cochran, jun., Paisley—Imp. in producing ornamental fabrics.
1104. F. P. Warren, East Court, Cosham, Hants.—Imp. in apparatus for steering sea-going vessels.
1105. M. Cartwright, St. John's-row, Hoxton—Imp. in the manufacture of models, and of plates or pieces for artificial teeth, and in combining or amalgamating india-rubber and gutta percha with metals for the manufacture of artificial plates or pieces, and for other purposes.
1106. W. J. Marsden, Sheffield—Imp. in eye-shades.
1107. W. E. Newton, 66, Chancery-lane—An imp. in setting artificial teeth. (A com.)
1108. W. E. Newton, 66, Chancery-lane—Imp. in the manufacture of cannon and other ordnance, and of solid and hollow cylinders for shafting and other purposes of wrought iron or steel, or both combined. (A com.)
1109. John Stanton, Birmingham—Imp. in apparatus or machinery to be used in stamping or piercing metal washers and other similar articles.
1111. J. Ashbury, Manchester—Imp. in the permanent way of railways.
1112. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in railway and common road carriages. (A com.)
1113. J. W. Ford, Shooter's-hill, Kent—Imp. in sewing machines. (A com.)
1114. J. Weston, 80, Upper Whitecross-street, St. Luke's—Imp. in chinery for morticing, drilling, and dove tailing, and in tools to be used therewith.

*Dated* 17*th April*, 1862.

1115. C. D. Abel, 20, Southampton-buildings, Chancery-lane—Imp. in the manufacture and production of the chromates and the bichromates of potash and of soda. (A com.)
1117. V. Fleury, 23, Rue de la Paix, Paris—Imp. in clocks and other time keepers.
1118. W. H. Hutchinson, Bury—Imp. in the manufacture of ammonia or its salts, and cyanogen or its compounds, from refuse gluten.

1119. J. Griffiths, Liverpool—Imp. in propelling ships and other navigable vessels.
1120. W. Harling, M. Todd, and T. Harling, Burnley—Imp. in looms for weaving.
1121. F. Tolhausen, 17, Faubourg Montmartre, Paris—An improved machine for making bricks, tiles, and the like articles. (A com.)
1122. J. Murphy, sen., Glasgow—Imp. in looms.
1123. J. P. Temperley, Soho Iron Works, Bolton-le-Moors—Imp. in the air pumps of steam engines.
1125. J. L. Perin, 97, Rue du Faubourg St. Antoine, Paris—Imp. in machinery for mortising wood.
1126. H. Gardner, Leeds—Imp. in machinery for breaking and preparing flax and other fibrous substances.
1127. C. D. Abel, 20, Southampton-buildings, Chancery-lane—Imp. in the manufacture and production of certain alloys containing cadmium. (A com.)
1128. R. A. Brooman, 166, Fleet-street—Imp. in taps and valves. (A com.)
1129. R. A. Brooman, 166, Fleet-sreet—Imp. in buffing apparatus, and in draw springs. (A com.)
1130. W. Anderson, 85, Shaftesbury-street—Imp. in tubular steam generators.
1133. W. Clark, 23, Chancery-lane—Imp. in the manufacture of railway rails. (A com.)
1134. J. C. Rivett, Prestolee New Mills, Farnworth, Lancashire, and J. M. Hetherington, Manchester—Imp. in machinery or apparatus for preparing cotton and other fibrous materials for spinning.
1135. R. Wedgwood, Barnes, Surrey—Improved apparatus for facilitating the saving of life in cases of fire.

*Dated 19th April*, 1862.

1136. R. Dennison, Lancaster—Imp. in reaping and mowing machines.
1137. E. Dove, Hunter-street—Imp. in matches and fuzees, and apparatus for containing and igniting the same.
1138. Major J. S. Phillips, 10, College-crescent, Finchley-road—A new method and apparatus for the propulsion of vessels through the water.
1139. J. Shanks, Barrhead, Renfrew, N.B.—Imp. in apparatus for promoting ventilation, also applicable to drying stoves.
1140. M. Masters, New Kent-road—Imp. in artificial legs.
1141. R. Stuart, G. Stuart, and H. Hill, Sheffield—Imp. in fastening flyers upon spindles.
1142. B. Rhodes, Old Ford-road, Bow—Imp. in the machinery for, and in the method of making, as also in the materials to be employed in the manufacture of, cylinders, tubes, and other vessels from paper and other materials or fabrics.
1144. B. Browne, 52, King William-street—Imp. in breech-loading fire arms. (A com.)
1145. E. Loysell, Cannon-street—Imp. in locks and fastenings.
1146. W. Rose, Hales Owen, Worcestershire—Imp. in the manufacture of tubes, more especially applicable to the barrels of fire-arms and ordnance.
1147. A. Parkes, Liverpool-street, Birmingham—Imp. in the manufacture of rollers for surface printing and embossing.
1148. A. N. Wornum, Store-street—Imp. in pianofortes.
1150. H. Lumley, Chancery-lane—An improved rudder.

*Dated 21st April*, 862.

1154. J. Pickard and T. Morris, Preston—Imp. in furnaces for the prevention or consumption of smoke.
1156. S. F. Griffin, New Adelphi-chambers—Imp. in the construction of vessels of war and batteries on land.
1158. E. F. Clarke, Waterloo, near Liverpool—Imp. in propellers for steam ships and other vessels.
1159. R. A. Brooman, 166, Fleet-street—Imp. in jackets or protectors for covering metal and other surfaces to prevent heat by radiation. (A com.)
1160. F. Tolhausen, 100, Fleet-street—An imp. in horse-shoes. (A com.)
1161. T. Attwood, Lewes—Imp. in kitcheners.
1164. J. C. Amos, The Grove, Southwark—An improved mode of, and imp. in apparatus for, supplying surface condensers with water, part of which improvements are applicable to blowers and rotary pumps generally.
1165. C. C. Creeke, Bournemouth, Hants—Imp. in the construction of drain and other pipes.

*Dated 22nd April*, 1862.

1170. C. Webster, Park-steps, Ilkeston-road, Radford, Nottinghamshire—Imp. in self-acting fountains adapted for garden engines, fire engines, and for raising and forcing water from mines, wells, and other places.
1171. A. Warner, Threadneedle-street—Imp. in the construction of vessels of war, and in floating or other batteries.
1172. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in apparatus for propelling and manœuvring ships. (A com.)
1173. G. Scoville, Wood's Hotel, Furnival's-inn—Imp. in pistons for steam-engines. (A com.)
1174. R. Boby, Bury St. Edmunds—Imp. in the construction of apparatus for rolling or crushing land.

*Dated 23rd April*, 1862.

1176. L. Holden, Burnley—Certain imp. in harness for animals of draught and burden.
1180. W. Carpenter, Greenwich—An improved method of printing in colours.
1182. A. Robertson, 22, Bachelor's-walk, Dublin, and R. Barter, St. Annes, Blarney, Cork—Imp. in apparatus for distributing and projecting fluids, either for surgical, sanatory, or domestic purposes.
1186. G. T. Bousfield, Loughborough-park, Brixton—Imp. in the construction of elliptic springs for wheel carriages and other purposes. (A com.)
1188. W. E. Newton, 66, Chancery-lane—An improved fertilizing composition.
1190. C. E. Heinke, 79, Great Portland-street—Imp. in diving helmets, dresses, and apparatus, parts of which imp. may also be employed for extinguishing fires in ships and other confined places.

### Patents Sealed.

[*From Gazette, May 2nd*, 1862.]

*May 2nd.*

2775. W. Hall.
2777. R. Fethney.
2779. E. Bowra.
5780. J. B. Love.
2783. H. Orth.
2787. A. Prince.
2789. F. H. Schroder.
2794. A. W. Williamson.
2799. J. Hancock.
2816. S. Hague.
2817. J. Fisher.
2844. L. F. Duval and L. A. Beaudet.
2845. M. Henry.
2848. J. Hodgkinson & D. Greenhalgh.
2854. T. Procter.
2875. J. Nixon.
2883. J. C. Goodall and J. Beale.
2902. J. Hemingway.
2945. J. H. Johnson.
2990. W. Clark.
3029. J. Burrows and J. Dougan.
3127. E. C. B. Beaulieu.
3142. E. C. B. Beaulieu.
355. W. Lyall.
405. W. Avery.
509. J. Imray.

[*From Gazette, May 6th*, 1862.]

*May 6th.*

2797. T. Schwartz.
2798. H. G. Gibson.
2801. J. Barrow.
2809. J. Byrne.
2811. D. Cowan.
2813. G. Simpson.
2814. R. McNair.
2819. R. A. Brooman.
2825. F. O'Reilly.
2827. D. Y. Stewart.
2833. C. O. Crosby.
2847. T. B. Collingwood and A. Butterworth.
2851. E. C. Kemp.
2928. W. E. Newton.
2989. A. V. Newton.
3222. T. E. Vickers.
528. E. G. Bruzaud.
567. J. B. Kendall.
583. H. Bunning.
587. B. Standen.

### Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, May 6th*, 1862.]

*April 28th.*

1067. R. Harrington.
1090. C. H. G. Williams.
1111. L. R. Blake.

*April 29th.*

1075. W. M. Cranston.
1083. J. Toussaint.
1085. E. Francis.
1182. H. Clarke.

*April 30th.*

1092. T. H. Harrowsmith.
1109. W. Sellers.

*May 2nd.*

1095. W. Bayliss.
1106. T. W. Miller.
1115. R. Mushet.
1123. J. F. Allender and D. Rowley.

*May 3rd.*

1150. R. Mushet.
1151. R. Mushet.
1173. G. Bell.

### Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, May 6th*, 1862.]

*April 28th.*

975. W. Hartley.

*April 30th.*

986. H. Lee and J. Gilbert.

*May 2nd.*

988. M. A. C. Mellier.

## LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| No. in the Register. | Date of Registration. | Title. | Name. | Address. |
|---|---|---|---|---|
| 4474 | May 5. | The Blanch Port-Cartouche, or Combined Rifle Ball and Powder Holder. | William Harnett Blanch ... | Liverpool. |
| 4475 | „ 6. | An Improved Trunk ... ... ... ... | Jas. Tasman (of the firm of Tasman and Co. ... | 11, Grocer's-hall-court, Poultry, E.C. |
| 4476 | „ „ | Clasp or Clip for Crinolines... ... ... ... | James Lamb ... ... ...<br>and<br>Harry Holdsworth and Co... | 37, Furnival-st., Sheffield, Yorkshire.<br>Spring Works, New George-street, Sheffield, Yorkshire. |